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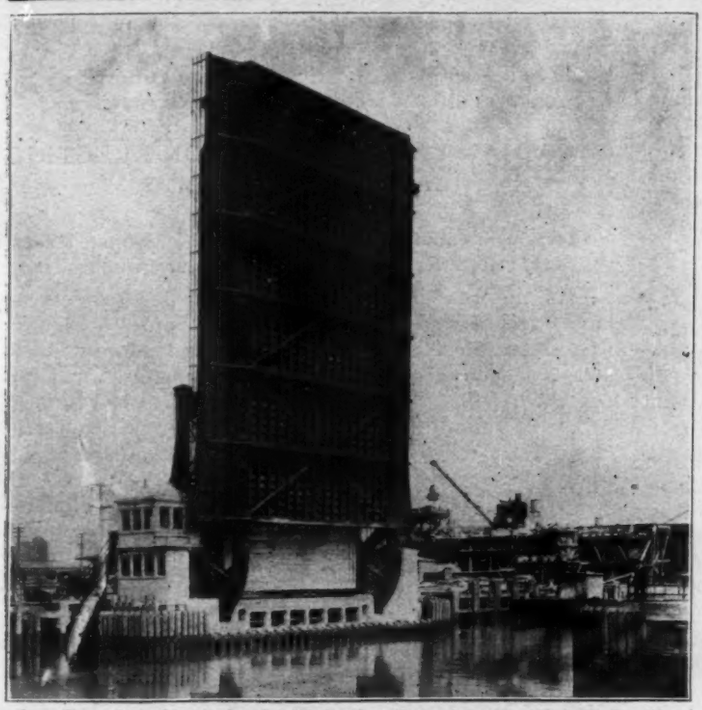

San Francisco Single-Leaf Lift Bridge Raised to Its Highest Position —Entire Operation of Bridge Is by Electrical Apparatus, Most of Which Is Automatic.

Electrically Operated Lift Bridge During Construction—View of Tower Which Contains Control and Motive Equipment.

An Electrically Operated Bridge in San Francisco

Features of Motive, Control and Safety Electrical Equipment Installed on Novel Single-Leaf Lift Bridge in Golden Gate City

THERE are three drawbridges operated by the city of San Francisco, the electrical installations for all of which were designed by the engineers of the Department of Public Works of that city. The most novel of these bridges is that at Fourth street.

The bridge in question is of single-leaf construction, with a span of 94 feet. It is counterweighted on the north side with a 700-ton overhead concrete weight spanning the roadway, the weight of the bridge being slightly overcome by the weight of the concrete.

The bridge is raised and lowered by two 25-hp. electric motors, series wound, with reversing controller and magnetic brake lock, the latter being operated by a 0.2-hp. motor.

The switchboard and all controls are housed in an observation tower with glass sides, enabling the operator to obtain an unobstructed view of the river in all directions as well as a view of Fourth street. The switchboard is equipped for the control of lock motors, lift motor and brakes, gates, alarm auxiliary lights, and also with the necessary voltmeters and ammeters.

When the bridge is about to be raised, an alarm bell is sounded at both ends of the bridge to warn all vehicles and pedestrians. The safety gates are then lowered and the bridge unlocked. It is impossible to unlock the bridge until both safety gates have been lowered. It is also impossible to start the motors that raise the bridge until the safety gates are properly lowered and the bridge unlocked. Energy for operating the motors that raise and lower the gates on the south side of the river is carried over a cable that is carried on the bridge, and the instant the bridge starts to raise the contact is broken, so that it is impossible to raise the south safety gates until the bridge is again lowered.

When the bridge is raised to a nearly upright position, the upward movement is automatically stopped, a short-circuiting device shutting off the motor and applying the brakes. By means of hand control of the motors and brakes provision is made to raise the bridge still farther to enable vessels of extraordinary large sails to pass. On lowering the bridge it is auto-

matically stopped just before reaching the final resting position, and it is then necessary for the operator to take charge of the controller and complete the lowering of the bridge. After the bridge has been lowered into its final position and then locked, a contact is made which permits the raising of the safety gates.

In the tower there are tell-tale lights which tell the position of the bridge, such as locked, open, bridge nearly raised, bridge fully raised, bridge nearly closed, bridge free.

An automatic semaphore is placed on both sides of the bridge to warn navigation of the position of the bridge, so that there will be no danger of collision during foggy weather or at night. This is operated very ingeniously. The semaphore consists of a semicircular lens, one-half of which is red and the other half white, and an electric lantern placed back of the lens and pivoted so that when the bridge is lowered the light shines through the red section of the lens; the red, of course, being the danger sign, indicates to navigation that the way is not clear. As the bridge is started upward the position of the lantern changes and when the bridge is raised sufficient to permit a vessel to pass the lantern is in a position back of the white lens, which gives a white light informing navigation that the way is clear.

An electrically operated bell is installed at all three bridges, and is connected with the central fire alarm station in Jefferson Park. When a fire is in a locality that will necessitate the fire department apparatus using any of the bridges a warning is sent out from the central fire alarm station by means of these bells. If a bridge is open it is closed as soon as possible, and if it is in a lowered position it is not raised under any consideration until after all fire department equipment has passed over the bridge.

NEW ZEALAND GOVERNMENT PURCHASES HYDROELECTRIC PLANT.

Another Plant Added to the Government System Which in Few Years Will Cover Both Islands.

The New Zealand Government has purchased the Horahora hydroelectric system from the Waihi Gold Mining Co. for $1,034,131, with the view of distributing electricity to the company's properties, other industrial enterprises, and homes in the Auckland province south of Auckland, New Zealand.

The Horahora electric power works, situated on the Waikato river a few miles beyond Cambridge, were erected by the Waihi Gold Mining Co. a few years ago at an expense of about $1,000,000. The present plant is capable of developing 9000 hp., and with the addition of two units at a cost of about $250,000, which it is expected will be constructed, soon will total 12,000 hp. for the hydroelectric works. The maximum demand of the Waihi company is 4000 hp., thus leaving 8000 available for distribution in the Waikato and adjacent districts as far north as Auckland, a distance of over 100 miles.

It may be a few years before the city of Auckland receives much power from Horahora, but with the construction of the additional two units it is estimated that 5000 or 6000 hp. would be available for that city. The present consumption in Auckland is between 12,000 and 13,000 hp., and whatever is obtained from Horahora will be in addition to the two local generating plants now operating in that city. The cost of the electricity from this plant is not fully determined, but it probably will be the same as that from the Lake Coleridge government plant in the South Island.

Horahora is only one step in the general hydroelectric development plan for New Zealand, and in the course of a few years the proposed Arapuni plant will be erected, which will be the main supply for the North Island, with several generators capable of producing 13,000 hp. each. In the face of the present critical coal shortage and the unpromising outlook for the future supplies of coal in New Zealand, it looks as though the hydroelectric developments in general will make great strides during the next few years.

CANADIAN EXPRESS RATES ON ELECTRIC INCANDESCENT LAMPS.

Protest by Manufacturers' Association Against Excessively High Rates Not Warranted by Conditions.

As the law in Canada now stands incandescent lamps are carried by the express companies at double first-class rates. The Canadian Manufacturers' Association, acting on behalf of the importers, is asking for the normal first-class rate. The association has recently submitted evidence showing that electric lamps were carried in the United States and from the United States into Canada at the first-class rate. It was further shown that 22% of the metal-filament bulbs and 70% of the carbon-filament bulbs exported from the United States in 1918 came to Canada.

The attitude of the express companies was that incandescent lamps were very bulky and light in proportion to other goods, the result being that cars were often loaded with electric bulbs to the exclusion of more profitable goods. To the contention of the importers that lighter articles, such as musical instruments, wicker furniture, tins, and wire goods, were carried at normal rates, the companies replied that these articles were not sent in such large quantities.

No decision was given by the board at the time of the hearing, and importers state that no judgment has yet been received by them as to the attitude of the board in the matter. The claim of the importer is that the only justification the express companies would have for charging such a rate would be the percentage of breakages being very high, and this was not shown by the companies in the case which they presented to the board.

COPPER PRODUCTION MORE THAN DOUBLED.

During the past four years the cost of producing copper has more than doubled, according to reports of producers. They show that the cost per pound in 1915 varied from 6 to 10 cents, while in 1919 this cost varied from 12 to 22 cents. Costs today are calculated on a somewhat different basis than in 1915 in that formerly no charge was made for depletion, and credits were allowed for gold and silver recoveries not now so treated; but these two items do not affect the comparison by more than 1 cent per pound.

Recent set-backs in the copper market have been due to the failure of export demand to materialize as expected. War-devastated Europe was counted on to absorb enormous tonnages of American copper in reconstruction, but to date foreign purchases have been small and until credits to foreign customers are forthcoming it is stated that it is needless to look for a correction of present conditions.

Central-Station Rates in Theory and Practice

Twenty-second Article—Importance of Accuracy of Rates—Inaccurate Rates Reduce the Profit and Impair the Service—Growth and Scope of Public Utility Regulation by Commissions

By H. E. EISENMENGER

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This series of articles, of which this is the twenty-second, was begun in the issue of July 12. The first seven articles constituted Part I and dealt with the cost of electric service. Part II contained six articles on the policies governing selection of a rate system. Part III included six articles describing the various systems of rates in common use. Two articles formed Part IV on rate analysis. The present article includes Part V and the first portion of Part VI, the remaining portions of which will be continued in the last three articles of the series.

PART V—ACCURACY OF RATES.

SECTION 171. We have seen that, regardless of whether we make the prices on the basis of the cost-of-service principle or the maximum-earnings principle or the value-of-service principle, there are always certain prices for every particle or for every class of service. These prices vary with the class of service according to the variation of the cost and, except in case of the cost-of-service principle, according to the variation of the profit.

Referring to the system of graphical rate representation explained in the preceding Sections (164-170) we can say that the *cost* of the various consumers (at least within one certain class of service) is roughly a Doherty plane. If the percentage of profit were to be constant for all sizes of customers this would result in another Doherty plane for the *prices* (rates) which is everywhere higher than the cost plane by just that percentage.

According to Sections 97-99 it will be of advantage for the producers as well as for the consuming public if the small consumers and the large ones get prices which are based on smaller profits than those charged to the consumers of medium size. Then the price (rate) surface will become curved, with the convex side pointing upwards.

We cannot follow this ideal surface exactly by the rate schedule, in the first place because we do not know the surface exactly and secondly because we do not want the rate system to become too complicated. The surfaces of most rate systems show a more or less close approximation to this vault-like curvature of the ideal surface by a substitution of a combination of planes in lieu of the curved surface. We see this approximation to the curvature for instance in the Wright demand rates, especially in those with a greater number of blocks, and still better in the double-block Hopkinson rate. (For photographs and drawings of models of this system, see H. E. Eisenmenger, "Space Representation of Central-Station Rates," *Electrical World*, Nov. 4, 1911, Figs. 13 and 14.)

The very fact that we have only an approximation to the ideal rate surface implies that we have certain inaccuracies of the rate. The rate will be just at its ideal or theoretical value at certain points of the bottom plane, that is for certain combinations of demand and energy consumption, but it will be higher than it ought to be at other points, and again lower at others. The smaller these inaccuracies are (with reasonable simplicity of the rate schedule) the better for the consumer and the producer.

172. The reason why every inaccuracy of rates is of disadvantage to both the consumer and the producer is this: Suppose certain customers (to be called Class A) are charged more than what is intended and would be theoretically correct, that is, more than what is to the best interest of all parties concerned (see Part II, Section 78 *et seq.*, "The Value-of-Service Principle"); other customers (Class B) are charged less than their proper amounts. The result will be that some of the customers of Class A will drop out or change the character of the service they require, in such a manner that they become Class B customers or approach to Class B customers. An inaccuracy of rates has therefore the following effect: Whatever class (or classes) of customers or service is affected in such a way by the inaccuracy that its rates and therefore its profitableness is reduced below the theoretical and intended amount, it will always be just that class which is increased in number and volume, and conversely just that class whose profitableness would be increased by the inaccuracy will—at least partly—disappear. Therefore every inaccuracy of the rate will of necessity reduce the profits and thus create a tendency towards raising the prices.

173. A separate and frequent case of rate inaccuracy is the case where one or two of the three charges (customer, demand, energy) are left out. In fact, as has been shown (Section 10) even rates which embody all three charges are necessarily inaccurate because an accurate rate would require an indefinite number of charges.

If, for instance, we suppress the demand charge (as in pure meter rates) the customers will get the use of the demand for nothing and consequently they will not care how large their demand is; they will be wasteful with their demand, so to speak. A customer using, for instance, 50 kw-hr. per month under a pure meter rate will have a larger maximum demand than a customer using 50 kw-hr. under a rate system where a charge is made for the demand. The consequence will be a smaller load-factor. For a given

kilowatt-hour consumption the central station has to keep in readiness a large generating capacity, etc., which reacts unfavorably on the cost and therefore on the price per kilowatt-hour.

On the other hand, if no energy charge is made (flat demand rate) the customers will be careful to keep down their maximum demand, or its rating-equivalent, respectively (capacity connected or connected load). In any case they will be far less careful about their number of kilowatt-hours (burning hours) than under a system of charging which makes a charge for every additional kilowatt-hour actually consumed. The only check which remains against absolute extravagance (outside of a feeling of fairness towards the central station on the part of a portion of the customers) is the cost of lamp renewals where these must be borne by the customer. The result will be that the load-factor of customers with a flat demand rate will be large.[1] A superficial observer who has accustomed himself to think in terms of average cost per kilowatt-hour may consider this an advantage because he knows that a large load-factor results in a low cost per kilowatt-hour. It must not be forgotten, however, that just in this case (flat demand rate) the central station is not paid for the additional kilowatt-hours furnished. The element that builds up the revenue is in this case exclusively the maximum demand and the larger the load-factor is for a given maximum demand the larger is the energy consumption for which the central station has to provide without getting any return.

Again, taking the case where the customer charge (and its substitute, the minimum charge) is left out of the rate schedule, this means that the very small customers will pay less than it costs to serve them; they can be carried only at a loss and, on the other hand, we have to give them service if they demand it. A customer charge or a minimum charge will either keep these unprofitable customers away or else raise their bills high enough so that they are turned into profitable customers. We can, in case of a suppression of the customer charge, not say that the *individual* customer is wasting anything, as in the case of the pure meter rate and of the flat demand rate, but the general average of the customers is wasteful, so to speak, without the customer cost, inasmuch as the small customers (whose customer cost would be a large percentage of their total cost) are unduly attracted.

It is always the element which is offered gratuitously or excessively cheaply with which the customer will be extravagant and in this manner the public service company will suffer damage from an inaccuracy of the rates and as the losses must, at least to a certain degree, ultimately be paid out of the customers' pockets the customers will suffer also.

174. It must not be overlooked, however, that the inaccuracies of the rate weigh differently in different places of the bottom plane. For illustration, if we have a residence rate it is necessary that it be accurate for small consumers but it does not matter if there is even a large inaccuracy for a residential customer of, say, 10 kw. demand and of some 2000 kw-hr. energy consumption per month because there will be very few, if any, residential customers who have a demand of that size and certainly none with a load-factor of that magnitude. A retail power rate, on the other hand, must be accurate for just that type of customers and its accuracy for the very small customers is not of such importance.

Fig. 23 shows a model constructed by the author several years ago in the course of an investigation of the rates of a company operating in a large city on the Pacific Coast. This model refers to the distribution of the residential customers of that company with reference to the size of the customers. The two horizontal axes of this model are kilowatts and kilowatt-hours, the same as in the rate models, but the vertical dimension is used for stepping off the number of residential customers. The ground plane (bottom plane) has been divided into squares (or rectangles) by using certain steps for the kilowatts as well as for the kilowatt-hours and then the number of residential customers to be found in each square in the territory

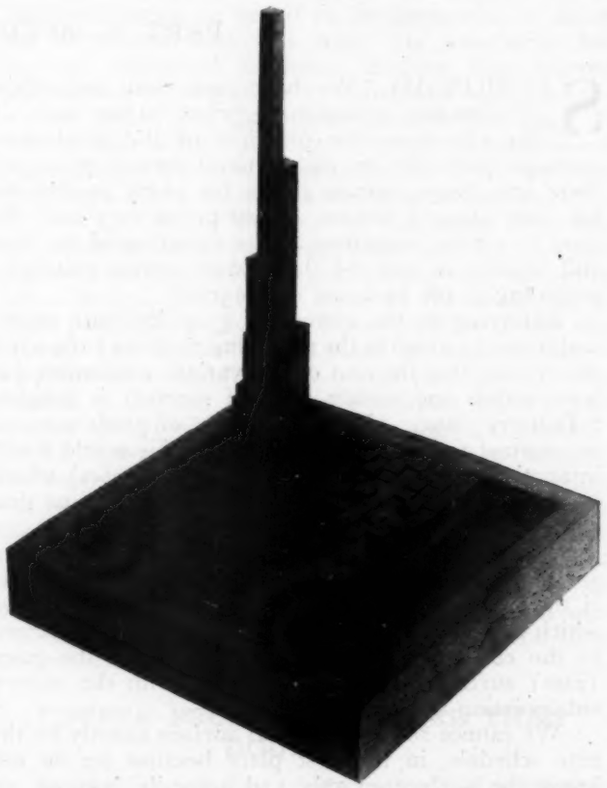


Fig. 23.—Distribution of Consumers of Different Sizes.

of the company has been stepped off as vertical ordinate. The model shows that in one of the "squares" the number of customers in existence is very much larger than in any other square and it further shows that practically all residential customers are crowded together—so to speak—in a very few, perhaps six, of the squares so that anything outside of these six squares is of little or no importance and the accuracy of the rate outside of these six squares is of no great consequence. A similar model has also been constructed, showing in the same manner the income from the various sizes of customers instead of their numbers in each group. The shape of this model which has a still greater bearing on the accuracy of the rates is, of course, in general similar to the one shown in Fig. 18 except that the maximum is moved a little further away from the origin.

[1] According to the information obtained by S. E. Doane and the author in Milan, Italy, it has been found in that city by using check meters that the average load-factor for small flat-rate customers was 2270 hours per year. The demand charge must therefore be large enough to cover the cost of this waste of kilowatt-hours, but as the increment energy cost per kilowatt-hour is very small the large reduction in the customer cost (see Section 128) and the other advantages make this system economical in spite of the waste of kilowatt-hours.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION.

CONTRIBUTED BY S. F. WALKER,
Formerly Associate Editor of Rate Research.

I. PUBLIC UTILITIES AND THE PUBLIC INTEREST.

WHAT ARE PUBLIC UTILITIES?

There is no generally accepted or legal definition of a public utility, or, looking at it another way, there is no generally accepted authority showing just what business enterprises may be brought into the program of public utility regulation and what industries may not be subjected to public service regulation as it has been set up in the various states.

In practically all of the state laws, public utilities have been defined by enumeration, the law stating, for example, that railways, electric, gas, telephone and water companies are to be subject to the regulatory powers vested in the commission. The policy of state regulation of public utilities has had a rapid extension. It has gone from state to state until every state, except Delaware, has some form of a railroad or public utility commission, and in various states the law has been amended year after year to include additional business enterprises. The question is, just where must this extension stop because the remaining unregulated businesses are not public utilities or are not subject to public regulation.

Franchise Companies.—Some authorities have held that public utilities are those companies which hold franchises to use the public streets. But regulation has gone beyond that limit.

Noncompetitive Enterprises.—Franchise companies were protected from competition, more or less. At least the field was not easily accessible to every one willing to come in and compete for business. On this basis some authorities have said that public utilities were subject to regulation because competition did not regulate their rates. But there are many monopolistic enterprises able to nullify the effect of competition in naming their prices that are not thought of in the same breath with public utilities. And, on the other hand, competition is a factor, often a ruling factor, in the rates of public utilities. There have been rate wars between public utilities that have driven rates lower than any commission would feel justified in imposing upon the companies, and it has often been one of the first tasks of a commission to bring such rate wars to a close and raise the rates to enable the companies to operate properly. The public utility rates are also affected by competition with other products. For example, electric companies are in competition with gas companies and with private plants for certain classes of service.

Commissions that have adhered strictly to the cost-of-service theory and have recorded their disapproval of "value of service" and "what the traffic will bear" methods, have often encountered situations where the theory cannot be followed, but where the rates for certain classes of the service are determined by the competition of other sources of fuel, light, power or whatever it may be.

Public Interest.—Taking refuge in a broader definition, public utilities are those companies whose business is clothed with a public interest.

The principle of public regulation was applied in early times to innkeepers, ferries, turnpikes, blacksmiths, and surgeons, because public welfare at that time was dependent upon obtaining these services at reasonable rates. This power to regulate in the interest of the public is held to be one of the inherent powers of the state, so much so in fact that the states cannot bargain this power away. It has been held that contracts, special charters and franchises granted a company or institution cannot debar the state from later imposing regulations contrary to the terms of such special grant, if it is in the interest of the public so to do.

EXTENSION OF PUBLIC REGULATION.

The state of Massachusetts established a Railroad Commission as early as 1869, and before 1890 there were railroad commissions in California, New York, and Iowa. The Interstate Commerce Commission was established in 1887.

Commission control of public utilities as it is known today may be said to have started with the Wisconsin and New York laws passed in 1907. Wisconsin established its Railroad Commission in 1905, and extended its power by the public utilities act of 1907. The New York law passed in the same year provided similar regulations of public utilities and other states have followed rapidly, keeping in general to the regulation of electric, gas, water, telephone, street railway, railroad, telegraph, and express companies, until the idea of public utility has been associated with these industries in a peculiar degree.

These industries might well ask, "Why is it so particular with us?" The business of furnishing food and clothing is certainly "clothed with public interest," and in fact, during the war period especially, has been subjected to regulation by administrative commissions in the interest of the public.

Commission regulation is not limited to natural monopolies and companies holding franchises, but may be extended at any time to such industries as public interest may dictate. There is no legal holding to the contrary.

In Oklahoma the Corporation Commission, provided for in the constitution of that state, was given general powers of regulation over all industries clothed with a public interest.

The provision of the Oklahoma constitution and the statute laws of that state relating to the establishment of the Corporation Commission and defining the powers of that body, while mentioning particularly railroad and transmission companies, include the following section going beyond any attempt at enumeration of public utilities subject to regulation.

Chapter 38, Article I, Section 13, Oklahoma Statute Law (1908): "Inevitable monopolies declared subject to price regulation by the state. Whenever any business, by reason of its nature, extent, or the existence of a virtual monopoly therein, is such that the public must use the same, or its services, or the consideration by it given or taken or offered or the commodities bought or sold therein are offered or taken by purchase in such manner as to make it of public consequence or to affect the community at large as to supply, demand or price or rate thereof, or said business is conducted in violation of the first section of this act (restricting combination in form of trust or conspiracy in restraint of trade or commerce within the state), said business is a public utility and subject to be controlled by the State, by the Corporation Commission or by an action in any district court

of the State, as to all of its practices, prices, rates and charges. And it is hereby declared to be the duty of any person, firm or corporation engaged in any public business to render its services and offer its commodities, or either, upon reasonable terms without discrimination and adequately to the needs of the public considering the facilities of said business."

An enumeration of industries in the different state laws has led to a more artificial idea of public utility regulation. While in one city or town the people are in need of having their electric company or street-railway company regulated, perhaps in other towns the people are more in need of having a meat market, a grocery, a warehouse, stockyard or perhaps even the dentist, the doctor or the lawyer regulated than the so-called public utilities.

Sometimes the commission regulation planned for companies known as natural monopolies has been extended to other classes of business under the same law—warehouses and cotton gins, for example, while other methods of regulation have appeared as anti-trust laws, food and drug acts, and special laws regulating the rates of insurance companies.

Just what the future limits of public utility regulation by commission will be cannot be foretold, but the tendency appears to be toward extension of the regulatory policy rather than toward restriction.

PURPOSE OF REGULATION.

The main purpose of regulation may be briefly stated as the securing of adequate service at reasonable rates, without unjust discrimination in either the furnishing of service or in the rates charged.

Proper regulation is concerned with the protection of the company, on the one hand, as well as the protection of the public, on the other.

Service.—The commission may determine what extensions and improvements in service are required to serve the best interests of the public and is given the power to order such extensions and improvements where the company has failed to make them of its own initiative.

However, the company is protected from unreasonable demands which would increase the investment in its property out of proportion to the public benefit secured.

The protection of the company against unreasonable service demands to the benefit of the general public has been most marked during the period of the war. Service improvements have been postponed, further extensions discontinued, requirements lightened, all at a time when the high cost of materials and labor would have imposed a high investment as a permanent burden upon the utility service.

Rates.—The public is entitled to service at reasonable rates, and the utility is entitled to a fair return on its investment and to compensation for good management. Rate regulation is only one of the phases of regulation, although it has been given the first place in public attention. Poor service at low rates may not be as good a bargain for the public as good service at high rates. The rates must be such as to afford proper inducement to capital and managing ability and to secure the benefits of new inventions and improvements in the industries concerned.

Rate Reductions.—The introduction of regulation was followed by a period of rate reductions. The public expected this of the commissions established. There were many factors making it possible, perhaps, for the various utilities regulated to withstand these rate reductions without harm. Under regulation the rights and duties of these companies were more clearly defined, thus giving them a more stable position. The stocks and bonds of the companies issued under commission approval had a ready market. The experimental period of development was over and the companies were entering upon a period of regular development. The companies were in many instances freed from losses from free service and discriminatory rates held over from the days of bargaining. And finally, a most important factor, rate reductions brought increases in business.

Increasing Rates.—During the period of rising prices, under war conditions, the commissions have found it necessary to grant increases in public utility rates. While there have been disappointments and delays in granting what companies have considered justifiable increases in some cases, it is undoubtedly true that increases in the emergency were secured more generally under commission regulation than could have been secured by bargaining with local authorities.

Reasonable Rates.—It is the duty of a commission to determine reasonable rates—not just nonconfiscatory rates. The courts had the power to prevent the exaction of a confiscatory rate, but the commission must go further and prescribe reasonable rates affording a fair profit to the company above all legitimate expenses of operation.

(To be continued.)

NEW SOURCE OF ALUMINUM.

Metallic aluminum can be obtained by electrolytic methods from its oxide; the oxide, however, must be free from iron and silica. The ore most commonly used is bauxite, after it has been purified by the costly Baeyer process. There being no bauxite in Norway, Prof. V. M. Goldschmidt, of the Mineralogical Institute, Christiania, in 1917, conceived the idea of using Labrador stone as a source of aluminum. By Goldschmidt's process, the Labrador stone is extracted from the plagioclase felspar by means of 30% nitric acid (the first raw product of the electrical air industry). The silica and the greater portion of the iron minerals remain insoluble, while aluminum, calcium and sodium go into solution, together with a little iron. After removal of this iron the solution is evaporated down to dryness, and the residue heated to a certain temperature at which the aluminum salt alone is decomposed, the nitric acid driven off being collected as a valuable concentrate. By washing with water the nitrates of calcium and sodium are removed, to be recovered and used in agriculture, whilst the aluminum remains. Since there are abundant supplies of the white, marble-like rock or plagioclase felspar, containing about 30% aluminum, in the southwestern part of Norway, this process seems full of promise for that country.

EFFECT OF AUTOMOBILES ON STREET-RAILWAY REVENUES.

A committee of the Massachusetts Legislature, which made a study of the street-car situation, has estimated that private automobiles, exclusive of "jitneys," reduced the income of the traction lines in that state 12%, and that, if this reduction were applied to the whole country in proportion to population, the total reduction in street-car earnings would amount to about $70,000,000 per year.

Electric Automechanical Handling of Freight Shipments

How Electrical Equipment Can and Is Already Solving the Freight Terminal Problem — The Gattie System in London— Cincinnati's Experience—Paper Before New York Railroad Club

By ZENAS W. CARTER

Secretary-Manager, The Material Handling Machinery Manufacturers' Association

THE railroads are to go back into private hands. The first problem executives and managing heads of all departments of railroading must face and work to solve is that of costs—both costs for materials and costs for manual service. The second problem is labor shortage. The third problem is lack of equipment. The fourth problem is condition of equipment. And last, but not least, is attitude and productiveness of the entire personnel from the section hand to the directing chief.

Unfortunately, under government ownership and especially on account of the war reaction which is influencing men so strangely, there has been little serious attempt on the part of the operating and working forces to keep down costs.

Further, man-power shortage is the natural result of the war. This same cause may be given as the reason for lack of railroad equipment and condition of equipment.

Depreciation in productiveness is partly psychological and partly the result of the sudden increase in the distribution and rotation of money among the masses. Rotation of money tends to develop a sense of luxuriousness which directly results in a slackening of effort.

Knowing the problem and the factors of the problem is half the solution, however, and the real work for the railroad executive is the application of methods which will change the factors into a co-ordinated unit.

It is possible, therefore, to visualize electric automechanical freight handling as a very important method which may be used to change the factors of high costs, labor shortage, lack of equipment, etc. We may even conceive that used thus, electricity may be the colloidal to improve both the attitude of the individual toward his labor and to increase his productiveness.

To visualize this it is only necessary to consider the changes electricity has already made in our daily life. And to make the application specific, as it relates to the use of electricity in new ways in railroad progress, it is only necessary to check over the present activity at some few points.

Proposed Central Freight Station for London Using the Gattie System.

For instance, few men in this country, even in the railroad lists, are familiar with the fact that the British Government is right now considering very seriously the elimination of every one of the 74 freight yards and stations in the city of London.

The idea is to combine the entire interchange of all freight, both carload and l.c.l. into one immense central freight station and distributing point. This would be absolutely impossible without electricity as the all-powerful, infinitely flexible force with which to operate.

When such an idea is even mentioned the average man simply must smile to himself and look to assure himself the man who makes the statement is not a victim of shell shock.

Nevertheless, this scheme, known as the "Gattie System," has received the consideration of the governmental and financial and business interests and is not at all an impractical proposition. Mr. Gattie has worked out every detail from planning an immense depressed area of 30 acres to be known as the "Crypt" to the detail of the floor sections and stalls on each of the planned nine stories of a gigantic 15-acre freight station. The "Crypt" will be used for all incoming trains and in making up trains to travel over all lines radiating in and out of London.

Of course the use of gondola cars in England—much smaller cars than in America—has made his plan workable, and he is to utilize the flexibility of electricity throughout to operate 196 powerful overhead electric traveling cranes, supplemented by a system of conveyors, the entire plant being planned to handle heavy loads in bulk. The cranes will lift uniform containers bodily from the platform of a car on the London & Northwestern, say, and take it over and place it on the platform of a car on the Great Eastern. This will eliminate the present need for that car to pass through dozens of switches and suffer from four to ten days' delay in its transfer across London.

In the handling of l.c.l. freight the containers are lifted bodily and taken to one of the four distributing floors. All goods, as they term freight in England, will then be handled from these central distributing floors to every part of that tremendous station by electrically operated conveying systems, escalators, elevators, chutes and electric trucks and trailers. Each lot goes from the central distributing floors directly to stalls where are particular containers for each railroad station or group of small stations.

These containers filled with goods for one particular town will be lifted bodily from the car platforms by local cranes when the train reaches that town. The car platform, then empty, may be at once utilized for a local container which has been previously loaded at that station just as we now load a boxcar with l.c.l., and the local traveling crane will place the container on the empty car platform and the train may then proceed towards its destination.

It will take just a little reflection to completely bring to your mind's view just what is necessary in the way of electric automechanical freight-handling equipment to completely handle a system of this kind.

Certain it is, however, that it is all possible through the use of electrically operated shuttle cars, electric traveling cranes, electrically operated conveyors of both the overhead trolley and the belt and apron and gravity types, and automatic elevators, and electric trucks and trailers.

The result of using such a system will be great economy, the release of the great spaces now used for yards and switch storage tracks and freight stations and it is figured that the value of the 74 stations will be much greater than the entire cost of the proposed gigantic central station.

This would also solve much of the problem of reducing freight-handling costs, labor shortage and equipment shortage. In addition, the psychological effect upon groups of men operating machinery under sanitary and healthful conditions in all kinds of weather, and with a minimum of physical effort, is certain to be such as to change their very attitude toward this work, while the synchronization of the whole would automatically speed up the productivity of each worker.

What is still more important, it would tend to give both regularity of hours of toil and continuity of employment, with a resultant uplift in the mental caliber of the men employed which would be incalculable.

Terminal System to Be Used in Cincinnati.

And just to prove that electricity right here in the United States is going to help solve the coming problem of the railroad executives and managers and employes of the railroads in the United States, all the railroads of Cincinnati, O., have made arrangements with a private operating company for the installation of a patented system of terminal operation.

This company has almost completed all the installation of the electrically operated machinery necessary to carry out its method of handling l.c.l. freight at Cincinnati, and it is my opinion this, or a similar system, is going to revolutionize the transfer-point interchange of l.c.l. freight all over the United States.

Starting from the results which will accrue at Cincinnati and working back to the principles of operation, the facts seem almost as revolutionary at first as the "Gattie System" will be in England.

For instance, this Cincinnati plan to handle freight by automechanical methods, using electric and gas motor trucks and machines instead of steam coal, switch engines, engine and switch train crews, and switches, is estimated to release 66,000 freight cars previously used exclusively in "spotting," transfer, trap or ferry service in the Cincinnati terminal territory.

There are problems one, two, three and four met in a way which at first tends to stagger even our American imagination. Cost is reduced, equipment both released and saved from deterioration, and labor shortage overcome.

But that is only part of the saving. The complete motorization of Cincinnati l.c.l. will save the railroads entering that city just about 300,000 switch cut movements per year and also will extend existing terminal facilities over 30% and make a reduction of 25 cents per ton in handling costs—all at the insignificant cost to the railroads of approximately $150,000.

Furthermore, to date over 140,000 tons of general classification merchandise freight have been moved without a single loss or damage claim resulting, and the current movement of all connecting line and substation freight has been greatly facilitated. Thus electricity functions tremendously as a force to help overcome these five problems of railroad management at Cincinnati.

The detail of the operation at Cincinnati is not a new untried scheme, as it has been under practical every-day test for almost two years between main and substations of the "big Four" railroad. The actual figures resulting from the tests were used in making the estimates for the complete plants now being installed.

Details of the Equipment and Method of Operation.

The system is a combination of motor truck, overhead electric traveling cranes and uniform containers, with which will ultimately be combined many forms of mechanical handling machinery, such as industrial electric trucks, stacking and tiering machines, portable conveyors and other electrically operated devices which reduce physical labor and tend to improve the morale of the men who serve in the handling of freight.

It is the combination which is the essential element of saving, as all of these devices and machines are now daily reducing manufacturing costs in most of our American industries and most of them will soon be in service at terminal and transfer points handling ocean and river cargoes as well as freight.

The handling of l.c.l. interchange at Cincinnati is as follows, bearing in mind that at the present time the railroads are not making any attempt at store-door delivery, although this also is undoubtedly going to be the outgrowth of the use of this system. At Cincinnati only railroad freight is being handled.

The cars are spotted alongside the freight station in the usual manner. Doors are opened and hand trucks or electric trucks receive the goods in the usual manner. They are then conveyed to the uniform containers and packed into the container identically as you pack a freight car.

These containers are placed in rows in the freight station, each container being plainly marked for one of the seven railroads entering Cincinnati. The containers are wood and steel boxes, 17½ ft. long, 8 ft. wide, 7 ft. high, and are usually loaded not to exceed 4 tons. The containers each have wide side doors and wide end doors so they may be easily loaded with miscellaneous freight of all kinds. Also each container (at least most of them) is fitted with large substantial casters so that it may be rolled across the station floor or rolled along the platform alongside a car.

When the container is filled or loaded it is lifted by a traveling electric crane, swung from its position and transported by the crane to the point where a motor truck chassis stands ready to receive the container as the complete body of the motor truck. Clamps are set and tightened, and the motor truck dashes off to the station of the railroad over which the goods in that particular container are routed.

At some stations the traveling crane delivers the container to the motor truck sidewise and at others the delivery to the chassis is endwise. In most cases where endwise delivery is made, and in cases where crane operation is not necessary on account of the few containers per day to be handled, the containers are set on a type of skid, which is just high enough and wide enough between its supports to permit the truck chassis to be backed underneath the container, and the lifting and lowering is then done through the use of electrically driven chain hoists. Where this latter method is in use, the skids are in bays extending into the station shed.

When the truck reaches the destined station, the traveling crane immediately relieves the chassis of the container and then places a return container on the chassis, effecting a minimum of delay for the motor truck. A central dispatcher handles the operation of all of the motor trucks, insuring their operation for a maximum percentage of the day.

The electric traveling crane of course carries the container with its load to the point nearest the spotted car of the connecting line and it is unloaded direct from the container into the car of the connecting line; or, if the goods in the container are for various small stations along the line, they are placed in proper cars in the usual manner, remaining in the container until cars are spotted for that particular freight division on which the station is located.

It is entirely practicable to haul the containers about by means of a winch or an electric tractor truck although they are not yet equipped for movement by electric tractor.

Of course, it is but a step from the development of this system into an electrically operated unit for the complete system of freight service, including delivery and receipt of freight from store door, which will be a very simple step ahead—involving merely the use of the same type of trucks and containers for the door-to-door service as is now employed in the inter-railroad service.

It is almost necessary for similar plans to be put into use throughout the country in order to meet the demands of the economic situation of costs, manual service need and equipment shortage.

Because of this engineers and railroad operatives are making exhaustive studies of these different machines and their co-ordination into handling systems.

With its adoption will also come a fuller appreciation by the railroads of the value of all types of mechanical handling machinery. In our manufacturing plants, men are given the benefit of every conceivable type of machine or device which will save physical effort and conserve time and energy, or speed up production, but as yet little use has been made of these electrically operated machines in freight and ocean cargo handling.

An automobile plant is equipped with numerous systems of conveyors, cranes, etc., all electrically operated. And in all large plants coal is handled by crane, belt conveyor or trolley with grab bucket, oftentimes without manual labor service from coal car to furnace grate bars, and even the ashes are automechanically carried to refuse piles.

Endless instances of the use of mechanical handling machines could be given where savings have resulted sufficient to pay for equipment in one or two months after installation, and it is logical to believe that the very first moves on the part of the actual owners of the railroads after Jan. 1 will be to purchase and install electric automechanical handling machinery of many kinds.

VALUE OF ELECTRIC COAL CUTTERS IN MINING.

British Mining Electrical Engineer Explains How They Can Increase Output of Collieries.

The use of electric coal cutters in collieries as a means of securing efficiency of production came in for consideration in the address of E. P. Hollis delivered at Birmingham, England, in November to members of a branch of the Association of Mining Electrical Engineers. He said that the electric coal cutter had won its spurs and was a most potent factor for increasing production; in fact, it was now realized that it was the only method of getting maximum production contingent, of course, upon the circumstances being favorable for its use. The introduction of a few of these machines in a casual way had to be guarded against very strongly, as it was not a proper test of their effect upon production.

Maximum production could only be obtained by machine mining on an intensive scale and that did not mean merely putting a few coal cutters into a mine. It meant very much more than that. If the maximum output was to be obtained from a mine it was necessary to provide for a mining scheme with the application of a maximum number of machines and after that to see that the hoisting plant was large enough to handle the output expeditiously, and that the various tunnels and passages about the mine were never congested. It is also necessary to see that the best hoisting and haulage systems available were installed. Properly equipped repair shops for all kinds of machinery must be provided. There must be sufficient spare units and it is necessary to standardize the plant throughout. More particularly was it necessary to make sure that adequate protection against breakdown was provided so that it was never possible for a section of the mine to be shut down through a breakdown of the plant serving it.

The care with which the plant in the mine was attended had also a bearing upon production. If through inefficient or inadequate care the plant broke down, the whole working of the mine might be disorganized, the scheme put out of gear, and in consequence there would likely be a big slump in output which could not be made up for a considerable period. That would be avoided if the authorities put in properly skilled attendants.

There was no industry into which the same degree of skill in electrical engineering was put as in the mining industry. Mr. Hollis said that from his own knowledge he was quite certain that the mining electrical engineer was not sufficiently consulted and therefore did not apply himself as closely as he might to the problems of production. If it were known to the mining electrical engineer that his experience was valued, and if it were appreciated that he could give most valuable advice and that his experience fitted him for grappling with the problems involved in increasing production, then he would be given incentive to apply his knowledge intensively to increasing production.

BRITISH MARKET FOR ELECTRIC WASHING MACHINES.

From investigation it is evident that the sale of imported electric washing machines for domestic use in Great Britain is confined to two or three large firms. The sale so far is not extensive and the prices are in the neighborhood of $200 to $250. In the opinion of several of the large distributors of electric power in the London area, there should be a considerable market for these machines in England, provided a machine could be offered at a price which would bring it within the reach of the average middle-class householder, who would be the type of citizen to whom the machine would most readily appeal. The servant problem and high laundry prices greatly assist in the demand for such labor-saving devices.

Co-operation of Central Station and Lumber Mills

Mill Refuse Utilized to Good Advantage Through Co-operative Arrangement in Three Cities in Gray's Harbor District of Washington — Steam and Electric Drive in Typical Mills and Shops

By W. A. SCOTT

THE three small cities of Aberdeen, Hoquiam and Cosmopolis on Grays Harbor, Wash., have become important centers of lumber manufacturing and other industries subsidiary thereto. In the operation of saw mills, planing and shingle mills, stave and box factories, machine shops and fish-packing plants in these communities there is a considerable consumption of power. Steam is the basic power, and this will continue to be so indefinitely by reason of the abundance of lumber-mill refuse available for fuel. While a number of mills are operated from steam-driven lineshafts, several others are operated either partly or entirely by electric motors. In the latter cases the electrical energy is produced by steam-driven generators, there being no hydroelectric power produced on Grays Harbor. In developing this energy there has been worked out an interesting case of co-operation between the central-station and lumber-mill interests.

Demands for electric power are increasing, and of all the electrical energy produced by the central-station company and at the lumber mills there appears to be practically no surplus. Among the mills in which direct steam drive is applied there is undoubtedly a tendency to change to electric power except for certain purposes. As the lumber demands are becoming heavy, and as the mills are running well up to capacity, the situation would seem to invite an increase in the production of electric power, and there are indications that some new generating equipment will be installed in 1920.

Central-Station and Street-Railway Service Co-operating with the Lumber Mills.

The Grays Harbor Railway & Light Co., of Aberdeen, Wash., is the public utility concern that serves light, power and local passenger transportation in these harbor towns. Its central generating station is situated about half way between Aberdeen and Hoquiam, which are about six miles apart. Its power plant equipment has a present capacity of 2400 kw. The steam plant comprises four Babcock & Wilcox boilers of 400 hp. each, which require about 35 cords per day of "hog" or lumber-refuse fuel, procured from the mill of Wilson Bros., in Aberdeen. A supply of 700 cords of this kind of fuel is kept on hand. To prepare this fuel requires the operation of a "hog" machine by a 125-hp. motor.

In the generating room there are two 1000-kw., 3-phase, 2300-volt turbogenerators operating at 3600 r. p. m., and another similar unit of the capacity of 400 kw. In addition to the above, there are two rotary converters of 500 kw. and 300 kw., for producing the 550-volt direct-current energy required for the company's street-car system. These cars are operated between Aberdeen and Hoquiam, and between Aberdeen and Cosmopolis.

The power company's output of electrical energy is considerably augmented by a co-operative arrangement that it has with the Anderson & Middleton Lumber Co., of Aberdeen. There is installed in the mill of this lumber company a General Electric 1000-kw. turbogenerator, belonging to the power company, but which is operated by the lumber concern. The output of this generator is divided, Anderson & Middleton commonly using about 300 kw., and 700 kw. is tied in on the power company's system.

Further, the power company also buys about 700 to 1000 kw. of surplus power produced in the mill of the Grays Harbor Lumber Co. at Hoquiam. Thus, the public utility concern, counting what is generated in its own plant and that which is secured from the lumber mills, is able to deliver nearly 4500 kw. of power for its own use and to its customers. It has 5714 light consumers in the towns on the harbor, and 190 power customers. In meeting these demands, the company serves energy at voltages of 2300, 440, 220 and 110, as single, two and three phase. Practically no direct-current power is required except for operating the street cars.

The important economic aspect of the situation is that waste fuel at the lumber mills is being converted into electrical energy, and that development along this line may be carried to the point of producing as much power as may be needed for all purposes.

Installations in Typical Lumber Mills.

The Grays Harbor Lumber Co., operating a large lumber mill at Hoquiam, uses both steam and electric drive, and has a surplus of 1000 kw. of electric power which is sold. The boiler capacity of this plant is rated at 1050 hp. Steam is required for the dry kilns, and for operating the log carriage, and some other machines, besides for driving the generators. Even though an abundance of electric power is available in this mill, it is stated that for a few machines steam has superior adaptability. The plant is equipped with three steam-turbine-driven generators as follows: A Westinghouse 1000-kw., and a General Electric 750-kw., both equipped with Wheeler surface condensers; also, a General Electric 500-kw. generator, equipped with a Worthington barometric condenser. The first two are 2300-volt units, the third producing current at 440 volts.

All motors of 50 hp. and higher are operated at 2300 volts, those below 50 hp. being operated at 440 volts. The 440-volt bus and the 2300-volt bus are tied together through three 200-kv-a. General Electric transformers. In the connected motor load of about 2000 hp. in this mill there are the usual fea-

tures of power transmission. The 11-ft. single-cut headsaw is driven at 10,000 ft. per min. by a 300-hp., 2300-volt, wound-rotor motor, of a speed of 600 r. p. m.; this is a belt drive on 13-ft. centers. The 14 by 72-in. Allis edger is operated by a direct-connected 400-hp. squirrel-cage motor, at 900 r. p. m. The trimmer, of 22 saws, is driven by a direct-coupled 100-hp. motor, at 600 r. p. m. Each of the three resaws is belt-connected to a motor.

In the planing mill there are five planers, including matchers and sizers, each machine being direct-connected to a motor of 50 to 75 hp. The refuse from the planing mill is handled by two motor-driven fans—a double 55-in. and a single 70-in. unit.

This lumber company supplies the city of Hoquiam with the electric power necessary to operate its pumping plant for delivering water to the city reservoir.

The Anderson & Middleton lumber mill at Aberdeen, which has a combination of steam and electric drive, is one of the plants in which electric energy may be greatly increased. There are here four Stirling boilers of a capacity of 2000 hp. The operation in this plant of a 1000-kw. generator, belonging to the Grays Harbor Railway & Light Co., has already been explained above. It was a case of installing the generator at a plant where the boiler fuel was produced. The electric drives in this mill are applied to the log-haul, resaws, planing-mill machines, two 84-in. refuse fans, circulation and hot-well pumps, and all conveyors and elevators. The transformer equipment consists of two 185-kv-a. transformers and two of 37½-kv-a., by which 2300-volt, three-phase energy is transformed to 480 volts, for the 440-volt motors; also one 25-kv-a. and two 10-kv-a. to step down to 110 volts for plant and yard lighting. The motor capacity in the plant amounts to 810 hp.

Steam drive is by means of a 24 by 48-in. Hamilton Corliss twin engine, connected to a main 350-ft. lineshaft by a 52-in. three-ply, waterproof leather belt, 110 ft. long. The 11-ft. bandsaw, with a 30-in. pulley, is driven from the main lineshaft through a Graton & Knight, two-ply, 26-in. leather belt, 90 ft. long, in which there is application of the plan of reverse drive. The bandsaw has a speed of about 10,000 ft. per min. The two "hog" machines, having a combined capacity of 60 cords of "hog" fuel per hour, are also driven from the main lineshaft through leather belts having a speed of 8200 ft. per min. The edgers and trimmer saws are also engine-driven through belt connection with the main lineshaft. It is understood that the Anderson & Middleton Lumber Co. has plans for installing a 1500-kv-a. generating unit, whereby practically the entire mill may be electrically operated.

The Grays Harbor Commercial Co., operating a plant at Cosmopolis, has a 750-kw. generating unit, and contemplates the early installation of another unit of like capacity to meet its power requirements. This company manufactures wood staves for pipe, silos and tanks, and makes boxes. It appears to have sufficient boiler capacity to furnish steam for the proposed new unit.

Bay City Lumber Co., of Aberdeen, and other concerns in this locality operate good-sized mills in which the principal drives are steam, but the facts above given serve to show the methods which are typical in this district. Storage-battery trucks and Ross Lumber carriers, also operated by storage batteries, are much used in the mill yards of this region.

The Lamb Machine Co., one of the electric-power customers of the district, operates a shop and foundry at Hoquiam for the manufacture of logging equipment and tools. A new feature in its foundry is a Greene 2-ton electric furnace, used for making steel castings, mostly from open-hearth steel. An accompanying illustration shows this furnace installed, ready for use.

The Northwest Electric & Water Works Co. operates a 500-kw. steam-electric plant at Montesano, and two small hydroelectric units, whereby light and power consumers at Montesano and Elma and vicinities are served.

A 2-ton Greene Electric Furnace for Making Steel Castings in Foundry of Lamb Machine Co., at Hoquiam, Wash.

Proposed Changes in Part II, National Electrical Safety Code

Principal Changes Proposed by Bureau of Standards in the Rules for Construction of Overhead Lines

MUCH controversy has been indulged in for several years and has now been revived with vigor respecting the rules governing the construction of overhead and underground lines that constitute Part II of the National Electrical Safety Code issued by the Bureau of Standards. When given their widest publicity in the 1916 edition of the Code they were declared by many central-station interests to be impracticable because they set standards that were too high and that would involve a prohibitive expense in execution. Other objections were also made. Much more objection was raised to Part II than to all other parts of the Code put together and the overhead line rules have remained the principal bone of contention respecting the Safety Code as a whole.

Since the 1916 edition of the Code is entirely exhausted, the Bureau of Standards has deemed it advisable to revise various parts of the Code before its republication. The revision of Part III, rules for utilization equipment, was completed some time ago; revision of Part I, rules for construction of central stations, substations and the like, was also completed a few months ago. It is not proposed to make any revision (other than correction of errors) of Part IV, rules for operation of generating stations and substations, before the next edition appears. This leaves the revision of Part II as the chief matter delaying the new edition of the Code and, as this third edition is clamorously being called for, the Bureau is anxious to complete the new Part II before the close of the year, if possible.

On account of the great interest taken in the revision of Part II, the short time in which it should be done, and the limited number of copies of the proposed changes available for general distribution, we give below an abstract of the principal changes in the first portion of Part II as suggested by the Bureau after extended investigation of the conditions existing and of the problems involved in complying with the standards of construction called for. The principal changes in the remainder of Part II will be given in our next issue.

A radical revision has been made in the arrangement of the rules in Part II with the belief that the new arrangement will facilitate the use of the rules and will be found much more satisfactory than that of the old edition. The proper requirements for rules 242*b* and 244 are still being studied by the Bureau and it will issue a special communication on these points later. One of the important proposals for change has to do with the voltage classification of supply lines crossing over signal lines as affecting the grade of construction required. A discussion of the reasons for this change will be appended at the end of the list, which gives the principal changes only, as the complete list includes a multitude of minor changes in phraseology, etc., that would be too voluminous for the space available. Where a rule is changed as to position as well as radically regarding text, the old rule number is given in parentheses. New rules are similarly indicated.

PRINCIPAL CHANGES IN SECTION 20 (SCOPE OF RULES AND GENERAL REQUIREMENTS) AND SECTION 21 (GENERAL RULES FOR POLE LINES).

Rule 203.—Minimum Requirements.—(Added paragraph.)—These minimum values are exceeded in much existing construction; service requirements frequently call for stronger supports and higher factors of safety than the minimum requirements of these rules.

210. Compliance with Other Rules and Special Precautions.—(New.)

(a) Other Rules.—The rules of this section apply to all supply lines, whether or not they are required by Section 23 to have a definite grade of construction. The additional requirements for supply lines in those situations which are required to have a definite grade of construction, A, B or C, will be found in Sections 25, 26 and 27.

The clearances and separations of conductors, climbing space, vertical wiring on poles and clearances from other structures shall comply with the requirements of Section 22.

(b) Special Precautions.—Where conductors are attached to structures other than those used solely or principally for supporting lines, all rules shall be complied with insofar as they apply, and such additional precautions as may be necessary shall be taken to avoid injury to such structures or to the persons using them. The supporting of conductors on trees and roofs should in general be avoided.

217. Strength of Poles and Crossarms.

(a) Poles.—Poles used for lines for which no designated grade is required shall be of such initial size, and so guyed or braced where necessary to safely withstand the loads to which they may be subjected, including linemen working on them.

(b) Crossarm Bracing.—(231*e*.)—Crossarms shall be securely supported, by bracing if necessary, so as to safely support loads to which they may be subjected in use, including linemen working on them. Any crossarm or buckarm, except the top one, shall be capable of supporting a vertical load of 225 lbs. at either extremity in addition to the weight of the conductors.

218. Conductors—Material and Minimum Sizes.

(b) Minimum Sizes.—(221*a* and *b*.)—Supply conductors in urban districts shall not be smaller than listed in the following table:

TABLE 1.—MINIMUM SIZES OF SUPPLY CONDUCTORS (URBAN DISTRICTS).

Soft copper	No. 6
Hard or medium drawn copper	No. 8
Steel	No. 9

Stranded Aluminum:	Spans 150 ft. or less	Spans over 150 ft.
Not reinforced	No. 1 A. W. G.	No. 0 A. W. G.
Steel reinforced	No. 6 A. W. G.	No. 4 A. W. G.

It is recommended that, except as modified in Rule 268, these minimum sizes for copper and steel be not used in spans longer than 150 ft. for heavy-loading districts.

219. Minimum Sizes and Sags of Service Leads.

(a) Above 750 Volts.—(273*c*.)—Supply service leads of over 750 volts to ground shall comply, as to sizes and sags, with the requirements for supply line conductors of the same voltage.

(b) Below 750 Volts.—(273*d*.)—Supply service leads of 750 volts or less in spans not exceeding 150 ft. shall be not smaller than the sizes listed in the table below. Such leads shall have sags not less than 12 ins. for spans 100 ft. or less, 18 ins. for spans up to 125 ft., and 27 ins. for spans up to 150 ft.

TABLE 2.—MINIMUM SIZES OF SERVICE LEADS BELOW 750 VOLTS.

Situation.	Spans 150 ft. or less.
Alone	No. 10 if soft copper
Concerned with signal lines	No. 12 if hard copper
Over supply lines less than 750 volts	No. 12 if steel

Over trolley less than 750 volts	No. 8 if soft copper
Over any trolley in rural districts	
Over supply lines of 750 to 7500 volts	No. 10 if hard copper
Over supply lines more than 7500 volts in rural districts	No. 12 if steel
Over trolley more than 750 volts in urban districts	No. 6 if soft copper
Over supply lines more than 7500 volts in urban districts	No. 8 if hard copper
	No. 9 if steel

= Grade C requirements.

Supply-service leads of 750 volts or less in spans exceeding 150 ft. shall be not smaller than required for grade C in Table 10, Rule 246, and shall have sags not less than required for grade C in the sag tables of Appendix A.

PRINCIPAL CHANGES IN SECTION 22—CLEARANCES AND SEPARATION OF WIRES.

220. Clearances of Conductors and Wires at Crossings.—(After table of clearances from ground or rails; new.)—For signal conductors along roads where the location of the pole relative to fences, ditches, embankments, etc., is such that the ground under the line will never be traveled except by pedestrians, the clearance above ground may be reduced to 10 ft.

For trolley contact conductors above 1500 volts to ground this clearance shall be increased by 2 ft.

Signal conductors below 150 volts to ground need have only 10 ft. clearance. Supply or other wires (except trolley contact wires) if below 150 volts to ground need not have more than 10 ft. clearance at entrance to buildings.

Where with guys crossing streets or alleys the section of the guy concerned is effectively insulated from the highest voltage to which it is exposed, up to 7500 volts, this value may be decreased, in urban districts, to 16 ft. at the side of the traveled way.

Increased Clearances—[3]—(265*c*).—Where the lowest supply conductor at a crossing over track rails is supported by suspension insulators, the initial clearances shall be sufficient to prevent the minimum clearances over rails given in Table 3 from being reduced more than 10% through the breaking of a conductor in either adjoining span.

222. Required Line-Conductor Clearances and Separations at the Supports.—(242.)

(*a*) *Line-Conductor Separations According to the Sags Concerned.*—The separation, at the supports, of the conductors of the same or different circuits of grades A, B, or C, shall in no case be less than the values given by the following tables, at 60 deg. F. without wind. The requirements of Rule 221 apply if they give a greater separation than this rule.

Separation in Inches Required for Line Conductors Smaller than No. 2 A. W. G.

(Formula: Separation $= 0.2$ in. per kv. $+ 6\sqrt{S/3 - 8}$, where S is the apparent sag in *inches* of the conductor having the greater sag, and the resultant separation is in inches.)

(See exception under Table 5, note *d*.)

TABLE 6.

	Sag in Inches						
Voltage.	36	48	72	96	120	180	240
750	12.0	17.0	24.0	29	34	43	51
2200	12.5	17.5	24.5	30	35	44	52
6600	13.5	18.5	25.5	31	36	45	53
22000	16.5	21.5	28.5	34	39	48	55
44000	21.0	26.0	33.0	38	43	53	60
66000	25.0	30.0	37.0	43	47	57	64

Separation in Inches Required for Line Conductors, No. 2 A. W. G. or Larger.

(Formula: Separation $= 0.2$ in. per kv. $+ 7\sqrt{S/12}$, where S is the apparent sag in *inches* of the conductor having the greater sag, and the resultant separation is in inches.)

(See exception under Table 5, note *d*.)

TABLE 7.

	Sag in Inches						
Voltage.	36	48	72	96	120	180	240
750	12.0	14.0	17.0	20	22	27	31
2200	12.5	14.5	17.5	21	23	28	32
6600	13.5	15.5	18.5	21	24	29	33
22000	16.5	18.5	21.5	24	27	32	36
44000	21.0	23.0	26.0	29	31	36	40
66000	25.5	27.0	30.5	33	36	41	45

For other voltages, separations may be calculated by formulae.

226. Clearances of Vertical and Lateral Conductors.—(246.)

(*c*) *Vertical Supply Conductors Through Signal Circuits on Poles Used Jointly by Supply and Signal Circuits.*—(New.)—Vertical supply conductors which run through a space occupied by signal circuits shall be inclosed from a point 4 ft. above the highest signal conductor or equipment, if the supply wire is below 7500 volts, or from a point 6 ft. above the highest signal conductor or equipment, if the supply wire is 7500 volts or over, to the ground in insulating conduit or mounted on pins and insulators as provided in (*e*) below.

Vertical supply-circuit ground wires which run through the space occupied by signal circuits shall be inclosed in wood or other insulating conduit from a point not less than 4 ft. above the highest signal conductor or equipment to the ground, except that within 8 ft. of the ground suitable mechanical protection as required by (*g*) below may be used.

227. Clearances of Conductors of One Line from Poles of Another Line.—(245*a*.)

Where conductors of one line are carried within 6 ft. from a supporting structure of a second line, and are not attached thereto, the clearance between the conductors of the first line and any part of the supporting structure of the second line, shall, if practicable, be not less than 3 ft. at 60 deg. F. and no wind. In no case should this clearance be less than the values required by Rules 221 and 222 for separation between similar conductors on the same support, increased by 1 in. for each 2 ft. of the distance from the supporting structure of the second line to the nearest supporting structure of the first line. The climbing space on the structure of the second line shall in no case be reduced by a conductor of the first line.

PRINCIPAL CHANGES IN SECTION 23—CLASSIFICATION OF CIRCUITS ACCORDING TO THE GRADE OF CONSTRUCTION REQUIRED.

230. Required Grades of Overhead Line Construction, and Arrangement of Levels.—(210.)

(*d*) *Limitation of Joint Use.*—(New.)—The joint use of poles by signal lines and supply lines above 7500 volts is not recommended except where it is physically or economically impracticable to separate the lines sufficiently to avoid conflicts.

Between 5000 and 7500 volts conditions in particular cases will determine whether or not joint use of poles is desirable. (See Rule 213 for equivalent lower voltages in grounded circuits.)

231. Supply Lines in Urban Districts (See Rule 251).

(*a*) *Grade B.*—(217.)—Supply lines over 7500 volts in urban districts, unless in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade B.

Supply lines of any voltage carried above lines over 7500 volts, unless the lower lines are in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade B.

(*b*) *Grade C.*—(New.)—Supply lines above 7500 volts in urban districts if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade C.

(Old No. 218 revised.)—Supply lines between 750 and 7500 volts in urban districts, unless in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade C.

Supply lines below 750 volts in urban districts, when carried above lines of between 750 and 7500 volts, shall comply with the requirements of Grade C, except when the lower line is in cable having permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c*, *d*, *e*, *f*.

Exceptions: Lines covered under (*a*) and (*b*) above, when on fenced rights-of-way, need not comply with the above requirements except where crossing over, conflicting with, or higher on joint poles with the conductors of other lines.

Constant-current circuits are included in (*a*) and (*b*) above, the voltage being the nominal full-load voltage.

(*c*) *No Grade.*—(New.)—Supply lines between 750 and 7500 volts in urban districts, if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rules 274*c*, *d*, *e*, *f*, need comply only with the general requirements of Sections 20, 21 and 22.

(Old 271*a* revised.)—Supply lines below 750 volts in urban districts, where alone, or where concerned only with signal lines, or only with supply lines below 750 volts, or both, need comply only with the general requirements of Sections 20, 21 and 22.

232. Supply Lines in Rural Districts (See Rule 252).

(*a*) *Grade C.*—(219.)—When either of two supply lines in rural districts, one above 7500 volts and the other below 750 volts, crosses, conflicts with, or has common poles with the other, the upper one shall comply with the requirements of grade C, unless the line of higher voltage is in cable hav-

ing permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c, d, e, f.*

(*b*) *Service Crossings.*— * * * Constant-current circuits are included in (*a*) and (*b*) above, the voltage being the nominal full-load voltage.

(*c*) *No Grade.*—(272*b.*)—Supply lines above 7500 volts in rural districts, where alone, or where concerned only with supply lines above 750 volts, need comply only with the general requirements of Sections 20, 21 and 22.

Supply lines below 7500 volts in rural districts, except as covered in (*a*) above, need comply only with the general requirements of Sections 20, 21 and 22.

233. Supply Lines Crossing Over Railways. (See Section 26.)

(*e*) *Street-Railway Crossings.*—Supply lines crossing over street railways on traveled portions of highways need conform only to general requirements, but when carried over trolley contact conductors shall have the same grade of construction as where crossing over supply lines of equal voltage (See Rules 231 and 232).

234. Supply Lines in Crossings, Conflicts, and Joint Use of Poles with Signal Lines. (See Section 27.)—(214.)

(*a*) *Grade A.*—Constant-potential alternating-current supply lines of over 7500 volts between conductors (or 4400 volts to neutral or ground), or constant-current circuits exceeding 10 amperes, or direct-current grounded trolley circuits of over 750 volts to ground, where at higher levels and crossing over, conflicting with, or having joint poles with telephone, telegraph, or other signal lines shall comply with the construction requirements of grade A, except as noted below.

(*b*) *Grade B.*—(215*a.*)—Constant-potential alternating-current supply lines of between 5000 and 7500 volts between conductors (or between 2900 and 4400 volts to neutral or ground), or constant-current circuits of between 7.5 and 10 amperes, where at higher levels and crossing over, conflicting with, or having joint poles with telephone, telegraph, or other signal lines, shall comply with the construction requirements of grade B.

(*c*) *Grade C.*—(216*a.*)—Constant-potential alternating-current supply lines between 750 and 5000 volts between conductors (or between 440 and 2900 volts to neutral or ground), and constant-current circuits not exceeding 7.5 amperes, where at higher levels and crossing over, conflicting with, or having joint poles with signal lines, shall comply with the construction requirements of grade C.

Where the supply lines over 5000 volts are in cable having permanently grounded continuous metal sheath or armor and are installed in compliance with Rule 274, grade C may be used for the supply line.

It is not intended that the requirements of (*a*), (*b*) and (*c*) above shall apply to supply lines at higher levels than signal lines, where over individual twisted-pair drop wires only, or where over other unimportant circuits only, if equally effective protection is secured by other methods of construction.

(*d*) *Double Crossing.*—(New.)—Where a line crosses in one span over two other lines, the strength of construction shall not be less than would be required if either of the two lower lines crossed the other.

For example, if a 2300-volt line crosses in the same span over a signal line and a direct-current trolley line over 750 volts, the 2300-volt line would be required to comply with grade A construction at the crossing. This is a double crossing and introduces a greater hazard than where the upper supply line crosses the signal line only.

(*e*) *Inverted Levels.*—Signal lines carried at higher levels than direct-current grounded trolley circuits of over 750 volts to ground in crossings, conflicts, or joint use of poles, shall comply with grade A construction, so far as mechanical strength is concerned. Signal lines carried over trolley contact conductors below 750 volts to ground shall comply with the requirements of grade C, as to conductor sizes and sags, with exceptions as noted in Rule 285.

In other situations, signal lines carried at higher levels than supply lines in crossings, conflicts, or joint use of poles, shall comply with the grade of construction required for the supply lines by (*a*), (*b*), or (*c*) above if in the reversed position, so far as mechanical strength is concerned, except as smaller wire sizes are permitted by Rule 285 for grade C signal lines.

235. Signal Lines Crossing over Railways. (See Section 28.)—(213.)

(*b*) *Grade E.*—Signal lines carried over tracks included in the following list shall conform to the requirements of grade E:

(1) Spurs not exceeding two tracks in the same span.

(2) Branches on which no regular schedule of operation is maintained.

(3) Narrow-gage tracks or other tracks on which standard rolling stock can not, for physical reasons, be operated.

(4) Tracks used only temporarily for construction or similar purposes for a period not exceeding one year.

(5) Tracks not operated as a public utility, such as industrial railways used in logging, mining, etc.

(*e*) *Street Railways.*—Signal lines carried over street railways not having overhead trolley contact conductors, need comply only with the general requirements for signal lines alone. (See Rule 288 and Sections 21 and 22.)

(*d*) *Trolleys.*—Where signal lines cross over trolley contact conductors, below 750 volts to ground, they shall comply with the requirements of Rule 285 as to conductor sizes and sags. For trolley contact conductors above 750 volts to ground, the requirements for crossing over supply lines must be met; namely, grade A for direct-current trolley lines, and grade A, B or C for alternating-current trolley lines, depending upon the voltage.

(*e*) *Signal Lines Classed as Supply Lines.*—Signal lines which are classed as supply lines (see def. 4), shall, where crossing over railways, comply with the construction requirements of Rule 233. (See Rule 289.)

PRINCIPAL CHANGES IN SECTION 24—SPECIFICATIONS FOR SUPPLY LINES OF GRADES A, B AND C.

241. Loads Assumed in Determining Stresses in Conductors.—(222.)

(*a*) *Assumed Loading of Wires.*— * * * The minimum temperature shall be assumed as 0 deg. F. for heavy-loading districts, 15 deg. F. for medium-loading districts and 30 deg. F. for light-loading districts.

Heavy loading for conductors consists of a horizontal wind pressure of 8 lbs. per sq. ft. of projected area and ½ in. of ice. Since the stress in the conductor does not in general exceed one-half the breaking strength for grades A and B, and 60% for grade C, this corresponds to a factor of safety of 2 for grade A and B and 1⅔ for grade C, based upon an 8-lb. wind and the ultimate strength of the conductor. Owing to the elongation of the conductor when stressed beyond the elastic limit, with the resulting increase of sag and decrease of tension, there is usually a greater factor of safety than 2 under normal conditions.

(*b*) *Loading Map.*— * * * (230*c*).—The localities in the different groups are classed according to the relative prevalence of high wind velocity and thickness of ice which accumulates on wires, light loading being in general for places where little if any ice ever accumulates on wires.

(*c*) *Modification of Loading.*— * * * (New.)—In case a state is redistricted by state administrative authority, so as to meet local weather conditions better than the map of Appendix A, a grade of loading above heavy may be used, if necessary, to meet such local conditions.

243. Strength of Steel Poles and Towers and Other Metal Supports.—(234*a.*)

(*a*) *Loads and Limiting Stresses.*— * * * (New.)—Guys are made of various grades of steel wire, the lowest grade generally having a strength of about 60,000 lbs. per sq. in., while the highest grade has a strength of 180,000 lbs. or more per sq. in.

For transverse strength in grade A construction heavy loading consists of a horizontal wind pressure of 12 lbs. per sq. ft. of projected area and ½ in. of ice. Since the stress in the steel does not exceed one-half the ultimate strength under these conditions, this is equivalent to a factor of safety of 3, based on an 8-lb. wind pressure and the ultimate strength of the steel.

245. Strength of Crossarms and Conductor Fastenings.—(231.)

(*a*) Crossarms of Selected Yellow Pine or Fir.*

	For grades A and B.	For grade C.†
2 or 4 Pin.	3 × 4 in.	2¾ × 3¾ in.
6 or 8 Pin.	3¼ × 4¼ in.	3 × 4 in.

(*b*) *Crossarm Strength.*—Crossarms for construction of grades A, B or C shall, when installed, withstand the vertical loads specified in Rule 222 without the stress under these loads exceeding 50% of the assumed ultimate strength of the material. They shall also withstand any unbalanced longitudinal stresses to which they are exposed with a limit of unbalanced tension where conductor pulls are normally balanced, of 700 lbs. at the outer pin.

246. Conductors—Material, Minimum Sizes and Sags.

(*b*) *Minimum Sizes.*—(221*b.*)—Supply wires shall not be smaller than indicated in the following table, except that longer spans may be used with any listed conductor size if the separations and clearances given in Section 22 and the sags given in Appendix A are correspondingly increased.

*If of other material they shall have at least equal strength.
†Grade C signal line crossarms may be 2¾ by 3¾ ins. for 6 pins, and 3 by 4 ins. for 10 pins.

TABLE 10.—MINIMUM ALLOWABLE CONDUCTOR SIZES.
A. W. G. for Copper and Aluminum—Stl. W. G. for Steel.

Medium or Hard-Drawn Covered Copper Wires.

Loading district.	Grade.	Limiting span length in feet 150	175	200	300
Heavy	A & B	6	4	4	2
	C	8	6	4	2
Medium	A	8	4	4	2
	B	8	6	4	2
	C	8	6	4	2
Light	A	8	6	4	2
	B	8	6	6	2
	C	8	8	6	2

Soft-Drawn Covered Copper Wires.

Loading district.	Grade	Limiting span length in feet 150	175	200	250	300
Heavy	A	4	2	1	...	...
	B	4	2	2	...	...
	C	6	2	2	...	...
Medium	A & B	4	4	2	1	...
	C	6	4	2	1	...
Light	A, B & C	6	4	4	2	1

Medium or Hard-Drawn Bare Copper Wires.

Loading district.	Grade.	Limiting span length in feet 150	175	200	300	400	500	700	1000
Heavy	A & B	6	4	4	4	2	2	...	....
	C	8	6	4	4	2	2	...	....
Medium	A & B	8	6	4	4	4	2	2	00
	C	8	6	4	4	4	2	2	00
Light	A & B	8	6	6	4	4	4	2	1
	C	8	8	6	4	4	4	2	1

Steel Wires.

Loading district.	Grade.	Spans 175 ft. or less.	Spans over 175 ft.
All	A & B	6	4
All	C	8	..

Aluminum Wires in Urban Districts.

Loading district.	Grade.	Spans 150 ft. or less.	Spans over 150 ft.
	Without steel reinforcement		
All	A, B & C	1	0
	with steel reinforcement		
All	A, B & C	6	4

Note—For sizes and material requirements of supply service leads see Rule 219.

Lightning-protection wires shall be regarded, in respect to size, material and stringing requirements, as supply conductors with which they are associated.

247. Line Insulators for Grades A and B.

(*b*) *Strain Insulators.*—(254*b*.)—Where strain insulators are used they shall be capable of withstanding without puncture under the normal mechanical stress at least as high a voltage as other insulators on the same line.

(*c*) *Insulators at Grounded Structures.*—Wherever wood pins and crossarms or other ungrounded supports are used within five spans of a crossing span with line conductors there attached to grounded metal pins, grounded crossarms, steel bridges, steel towers or other grounded structures the insulators at the grounded supports shall be capable of withstanding without flashover a voltage 50% higher than those used at adjacent ungrounded supports.

Where the supporting structures for the crossing span are the same as for other parts of the line, the insulators used may also be the same.

The above may be met by installing insulators within five spans which will withstand a flashover voltage of only two-thirds the voltage which those at the grounded structure will stand, provided the other requirements of this rule are still met.

248. Special Transverse Strength Requirements.

(*a*) *Alternate Construction in Special Cases* (3).—(233*c*.)—The entire section between the transversely strong structures shall comply with the highest grade of construction concerned in the given section, except as to the transverse strength of the intermediate poles or towers.

(*b*) *Strength of Crossarms and Pins.*—(233*b*.)—The crossarms, insulator pins and conductor fastenings connected to the structure at each end of the transversely weak section shall be such as to withstand, under the conditions of loading prescribed in Rule 241 an unbalanced load equivalent to the combined pull in the direction of the transversely weak section of all the conductors supported up to 10,000 pounds for grade C, plus one-half the excess for grade A, or plus one-fourth the excess for grade B.

249. Longitudinal Strength Requirements for Sections of Grades A and B Construction in Certain Special Cases.

(*c*) *Methods of Providing Strength.*—(266*c*.)—The requirements of (*a*) are usually met by placing supporting structures of the required longitudinal strength at either end of the higher grade section of the line.

Where this is impracticable the supporting structures of the required longitudinal strength may be located one or more span lengths away from the section of higher grade, within 500 ft. on either side and with not more than 800 ft. between the longitudinally strong structures, provided such structures and the line between them meet the requirements, as to transverse strength and stringing of conductors, of the highest grade occurring in the section, and provided that the line between the longitudinally strong structures is approximately straight or suitably guyed.

PRINCIPAL CHANGES IN SECTION 25—REQUIREMENTS FOR SUPPLY LINES, INCLUDING ELECTRIC RAILWAY FEEDERS.

250. Compliance with Other Rules.

(*a*) *Grade A, B or C Construction.*—(New.)—In addition to complying with the requirements of Sections 21 and 22, the requirements of this section shall be met by all supply lines in urban and rural districts where a definite grade of construction (A, B or C) is required by Section 23, except in the important cases of crossings over railways or signal lines and the joint use of poles, which are covered by Sections 26 and 27.

(*b*) *Special Strength.*—(New.)—Special longitudinal strength requirements are made in Rule 249 for crossings of supply lines below 7500 volts over supply lines above 7500 volts.

(*c*) *Dead Ends.*—(274*b*.)—Where supply lines over 7500 volts in urban districts come to dead ends or to changes in line direction (even where no crossing exists) the end shall have construction complying with the longitudinal strength requirements of Rule 249.

(*d*) *Clearances.*—(New.)—For clearances of conductors and wires above roadways, railways, and footways, and from other conductors and wires, see rules 220*a* and *b*, 257, and 258.

251. Supply Lines in Urban Districts.

(*a*) *Below 750 Volts.*—(271*a*.)—Supply lines below 750 volts in urban districts, where alone, or where crossing over, conflicting with, or where higher on common poles with, other supply lines below 750 volts need only comply with the general requirements of Sections 20, 21 and 22.

(New.)—If the lower supply lines have a voltage over 750 volts and are not in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rules 274*c*, *d*, *e*, *f*, both lines shall comply with the requirements of grade C; if over 7500 volts and not in such cable, both lines shall comply with the requirements of grade B.

(*b*) *Between 750 and 7500 Volts.*—(271*b*.)—Supply lines between 750 and 7500 volts in urban districts, where alone, or where crossing over, or conflicting with, or where higher on common poles with, other supply lines not over 7500 volts shall comply with the construction requirements of grade C, as given in Section 24, unless the supply lines are in cable having permanently grounded continuous metal sheath or armor and are installed in compliance with Rules 274*c*, *d*, *e*, *f*, in which case no grade is required.

If the lower supply lines have a voltage over 7500 and are not in such cable, both shall comply with the construction requirements of grade B.

(*c*) *Over 7500 Volts.*—(271*c*.)—Supply lines over 7500 volts in urban districts where alone, or on the same poles with other supply lines of any voltage, or crossing or conflicting with such lines, shall comply with the construction requirements of grade B, except as covered in the next paragraph.

Such lines, if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, need only comply with the construction requirements of grade C.

252. Supply Lines in Rural Districts.

(*a*) *No Grade.*—(272*a*, *b*.)—Where supply lines of any voltage in rural districts are not concerned with crossings of railways or signal lines, or conflicts or joint use of poles with signal lines, no grade of construction is required for conductors or supports, except as noted in (*b*) below. Such lines are subject only to Rule 246 for conductor materials, and to Sections 20, 21 and 22 for isolation, guarding, clearances, and pole arrangement.

(*b*) *Grade C.*—(272*c*.)—When either of two supply lines in rural districts, one above 7500 volts and the other below 750 volts, crosses, conflicts with, or has common poles with the other, the upper one shall be of grade C, unless the line of higher voltage is in cable having permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c*, *d*, *e*, *f*.

256.—Electric Railway Construction.

(*d*) *Strength of Construction in Urban Districts Generally.*—(276*h*.)—Trolley contact conductors, feeders, and their supports, in urban districts, shall comply with the strength requirements for supply lines of equal voltage. Direct-current circuits of over 750 volts to ground where at higher levels and crossing over, conflicting with, or higher than and having joint poles with, signal lines shall comply

with the requirements of grade A (see notes under Rule 234 for special cases).

257. Wire Clearances Above Railways, Roadways, and Footways.—(276*j*.)

(2) Above streets or alleys, roadways, or footways, including track rails of railways where brakemen are not permitted on top of cars, the trolley contact conductors, when not over 1500 volts to ground, shall have a minimum clearance of 16 ft., and when above 1500 volts to ground shall have a minimum clearance of 18 ft.

This clearance is the minimum clear height in the middle of the contact conductor span. The point of support at the pole structure should be not less than 2 ft. higher, thus allowing for maximum sag in span wire and trolley contact conductor at 60 deg. F.

PRINCIPAL CHANGES IN SECTION 26—CROSSINGS OF SUPPLY LINES OVER RAILWAYS.

260. Grades of Construction.—(261*a*.)

Overhead supply lines (or signal lines which have taken on the character of supply lines) crossing over railways shall comply with the construction requirements of grade A, except when over sidings, spurs, branches, or other minor tracks only, in which case they shall comply with the construction requirements of grade B. (See Rule 233 for full statement.)

265. Increase of Clearance in Special Cases.

(*d*) *Increases Cumulative.*—(New.)—The above increases are cumulative when more than one applies.

PRINCIPAL CHANGES IN SECTION 27—SUPPLY LINES OVER SIGNAL LINES AND JOINT USE OF POLES.

270. Special Requirements and Compliance with Other Rules.

(*a*) *Grade of Construction.*—(268*a*.)—Overhead supply lines crossing over signal lines under the circumstances noted in Rule 234 shall comply with grades of construction A, B or C, as noted in the rule referred to.

(*f*) *Clearance Increases.*—(268*f*, *g*, *h*.)—The increases of clearances for longer spans, higher voltages, and for suspension insulators, shall be as given in Rule 220*b*.

(*g*) *Special Requirements.*—(268*i*, *j*, *k*.)—Special longitudinal strength requirements are given in Rule 249.

Requirements for protection against conductor breakage are given in Rule 266.

272. Joint Use of Poles by Signal and Supply Lines—Supply Lines Above Signal Lines.

(*a*) *Avoidance of Conflict.*— * * * —(New.)—The joint use of poles by signal lines and supply lines above 7500 volts between conductors (or 4400 volts to neutral or ground) is not recommended, except where it is impracticable to separate the lines sufficiently to avoid conflicts.

Between 5000 and 7500 volts between conductors (or between 2900 and 4400 volts to neutral or ground) conditions in particular cases will determine whether or not the joint use of poles is desirable.

The general requirements of Sections 20, 21 and 22 shall be complied with, except as modified in the following paragraphs.

(*b*) *Strength of Poles.*—(286*a*.)—Poles used jointly by supply lines and signal lines with the supply lines above shall have the highest grade of construction specified in Rule 234 according to the voltage and character of the various lines carried by the pole.

Where the signal lines are used exclusively in the operation of supply lines the pole strength need not be that required above, but the lines shall occupy the same relative positions noted under (*f*) below.

(*e*) *Longitudinal Stresses.*—(286*a*6.)—In calculating the longitudinal stresses upon jointly used poles complying with grade A or B construction requirements where crossing over railways or over signal lines (where these crossings would of themselves require compliance with grade A or B construction of the crossover span to meet the special longitudinal requirements at such points the tension in the signal conductors may be considered as limited to one-half their breaking strength provided they are smaller than No. 8 Stl.W.G. if of iron or No. 6 A.W.G. if copper, regardless of how small the initial sags of the signal conductors at 60 deg. F.

273. The Joint Use of Poles by Signal and Supply Lines—Signal Lines Above Supply Lines.

(This relation of levels is not in general desirable, and should be avoided where practicable.)

(*a*) *Strength Requirements.*—(287.)—Poles or towers used jointly by signal and supply lines, with the signal lines above the supply lines, shall comply with the requirements and rules referred to in Rule 272 as well as those in this rule.

(*b*) *No Reduction.*—The grade of construction A or B where required for the signal lines, includes the size, material, and sag of conductors as well as the strength of structures required for supply lines of the same grade by Section 24 with no reduction in transverse strength requirements such as is permitted by Rule 272*d* where supply lines are above signal lines.

(*c*) *Grade C Signal Conductors.*—(221*e*.)—Signal conductors which are required to comply with grade C construction may be smaller than Grade C supply conductors but not smaller than given in the following table:

TABLE 12.
(221 *e* revised.)

Span Length and Sag.	Material.	Sizes.
Spans not over 100 ft. with sags not less than 12 ins., and spans over 100 ft. but not over 125 ft. with sags not less than 15 ins.	Hard copper Steel	10 12
Spans over 125 ft. but not over 150 ft. with sags not less than 18 ins.	Hard copper Steel	9 11
Spans over 150 ft. with sags of Grade C supply conductors or more, as given in Appendix A.	Hard copper Steel	Sizes of Grade C supply conductors as given in Rule 246.

Paragraph 272*d* does not apply to such conductors.

274. Joint Use of Poles by Cabled Supply Lines and Signal Lines.—(New.)

(*a*) *Requirements When Cable Is Unsheathed.*—Poles used jointly by signal lines and cabled supply lines not having permanently grounded continuous metal sheath or armor shall meet all the requirements for poles used jointly by open supply and signal lines given in Rule 272.

(*b*) *Strength of Poles When Cable Is Sheathed.*—Cabled supply lines having permanently grounded continuous metal sheath or armor shall be installed in compliance with (*c*), (*d*), (*e*) and (*f*) below. When the voltage of the cabled supply lines is over 750 the poles shall meet the strength requirements of grade C as given in Section 24.

(*c*) *Messengers.*—Messengers shall be stranded and of galvanized or copper-covered steel with strengths and sags as specified in Rule 280, or if of other sizes shall not be stressed beyond half their ultimate strength when the cable and messenger are coated with ½ in. of ice and subjected to a transverse wind pressure of 8 lbs. per sq. ft. of projected area.

(*d*) *Grounding of Cable Sheath.*—Each section of cable between splices shall be suitably and permanently bonded to the messenger wire at not less than two places. The messenger wire shall be grounded at the ends of the line and at intermediate points not exceeding 800 ft. apart. (See Section 9 for method.)

(*e*) *Splices.*—Splices in the cable shall be so made that their insulation is not materially weaker than the remainder of the cable. The sheath or armor at the splice shall be made electrically continuous.

(*f*) *Insulation.*—The conductors of the cable shall be so insulated as to withstand a factory potential test of at least twice the operating voltage at operating frequency applied continuously for 5 minutes between conductors and between any conductor and the sheath or armor.

275. Special Crossing Construction.

(*b*) *Cradles.*—(New.)—Cradles are not recommended. It is believed better to build the supply line strong enough to withstand extreme conditions than to build a cradle of sufficient strength to catch and hold the supply line if it falls.

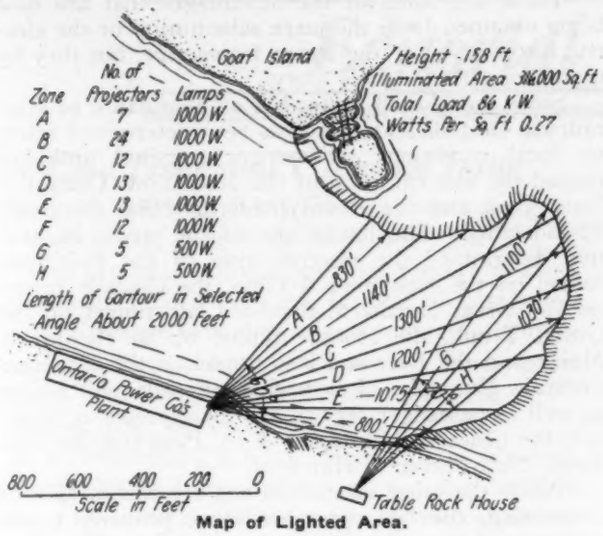
(To be concluded in the next issue.)

FLOOD LIGHTING OF CANADIAN FALLS AT NIAGARA.

Remarkable Effects Secured by Use of 91 Projectors—Prince of Wales Lights Installation for First Time.

Lifting himself by his boot straps is something man has yet to accomplish. But he has by his ingenuity enabled the Horseshoe Falls at Niagara to illuminate themselves. It amounts to that. Because the force of water that goes tumbling over the falls supplies the power utilized in generating the electrical energy which, through the medium of 91 projecting lamps, of a total load of 86 kw., makes the view of the falls by night more awesome even than it is by day.

The Prince of Wales it was who supplied the final touch that made the lighting of the falls an accomplished fact. On the evening of Oct. 18, while a visitor at the home of Dr. Harry Grant, park commis-



Map of Lighted Area.

Battery of Projectors on Roof.

sioner of Queen Victoria Park, the Prince pushed the button that made the view of the falls by night more fascinating even than it is by day.

The illustrations convey only so much of the witchery of the view of the electrically lighted falls as can be caught by the unimaginative camera. One must visit the falls to secure the full effect. Then one becomes an active advocate of the policy of flood lighting all show places.

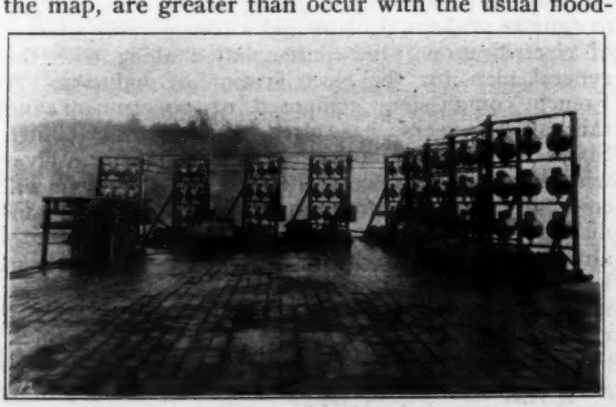
The lighting is by means of a main and a secondary battery of projectors, located with careful regard for all essential considerations. The plan of illumination installation shows the location of the main battery on the corner of the roof of the Ontario Power Co.'s plant, and of the secondary battery on the roof of Table Rock House. From the location of the main battery light can be directed to all parts of the falls, with the unique advantage also that the apparatus makes no bid for the attention of sightseers during the daytime. It does not intrude upon their gaze; only those having a special purpose will spy out its location. Another advantage of that location is that it is adjacent to an ample source of power. But there is one disadvantage necessitating the installing of the secondary battery on Table Rock House and which results from the occasional rising clouds of spray. When the spray is up it is impossible to see from the roof of the power house the crest of the falls near the apex of the horseshoe. This necessitated the installing of the secondary battery of ten 500-watt short-focus projectors on Table Rock House.

The distances, as will be seen by an inspection of the map, are greater than occur with the usual flood-lighting problem. The height of the falls is 158 ft. And at the longer distances the diameter of the beams is greater than is necessary to cover the face of the falls. Where this occurs the top of the beams are directed to the crest, while the diffused light from the main projectors is depended upon to illuminate the waters at the base of the falls.

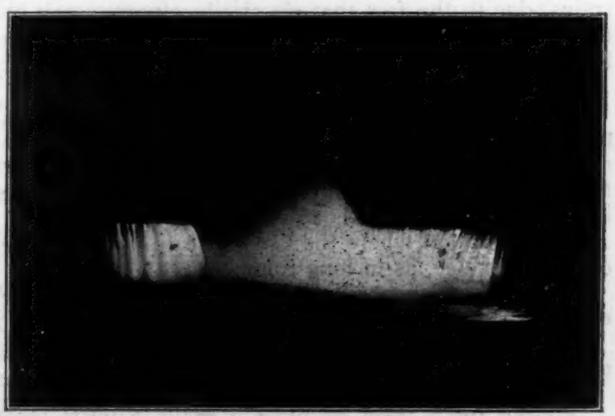
No attempt has been made to penetrate the rising spray with artificial light, because even though this were done the view of the falls would still be obstructed by the spray itself. Better results have been attained by lighting up the falls by means of the secondary battery on Table Rock House from which a splendid view is had. It was found too, in the final adjustment of the beams, that more of the contour of the falls towards Goat Island could be illuminated than is shown in the map and each zone was spread out slightly to accomplish this end.

The installation was designed and erected by the engineers of the Hydro-Electric Power Commission of Ontario, and George Beattie, of the Electric Shop, Toronto, Ont., co-operated with the Commission and supplied the reflectors. Long-focus projectors, utilizing the regular type of gas-filled lamps, comprise the main battery. These were selected because such lamps are more readily obtainable, and also because it was not thought necessary to utilize high beam concentration. The areas to be lighted are large and they are both vertical and horizontal. And as all the light below the rim of the falls illuminates interesting surfaces there is little or none of it that can be deemed wasted.

The main battery is divided into nine banks of nine



Rear View of Projectors.



Niagara's Horseshoe Falls Floodlighted.

units each, and each of the 81 projectors contains one 1000-watt lamp. Each bank is equipped with a service box containing fuses and switch and is a complete three-phase unit in itself. And all service boxes are protected from spray to tight fitting wooden housings. Flexible conduits connect the subfeeders to the projector sockets. The conduits are securely fastened at each end so that any accumulation of ice will not impose a strain on the wires. Three 30-kw. transformers, located close to the projectors, are connected to the 2200-volt buses in the power house by lead-covered cable in conduit. Weatherproof cable is used for low-tension feeders.

PROSPECTS OF RAILROAD ELECTRIFICATION IN AMERICA AND ABROAD.

General Survey of Conditions Indicates That Extensive Electrification Will Be Brought About During Next Decade.

By F. H. Shepard,

Director of Heavy Traction, Westinghouse Electric & Manufacturing Co.

The world-wide shortage of coal during the great war and the present coal tieup in this country have emphasized more clearly the necessity of fuel economy in industry, while the present general shortage of labor and the certainty of its continuing scarcity throughout the reconstruction period forms another most serious problem. But fortunately we have at our disposal a means that will greatly assist in alleviating both of these conditions, namely, electrification.

The use of electricity in industry saves both fuel and labor. This fact is recognized throughout the world today, and in order to secure these advantages, practically all of the nations are now considering plans for the electric generation of power. In England, Belgium and France, among other countries, these plans are being prepared by official commissions so that a tremendous activity in electrical power development may be expected with the stabilization following the advent of peace. In all cases the ideal in view is a broad one: To use electricity for all possible power purposes, including railroad operation.

The operation of the railroads will naturally form an important part of any program of general electrification, for in almost every country the railroads form one of the largest users of fuel and labor. Nor are the advantages obtained from railroad electrification limited solely to economy in fuel consumption and the more effective use of labor. Among others, the following can be mentioned:

1. Greater speed of movement for the heaviest trains, due to the fact that electric locomotives can be made much more powerful than the largest steam locomotives.
2. Greater nicety of control.
3. Increased traffic capacity of existing tracks, terminals, grades, tunnels and other points of traffic restriction, because when electricity is used, heavier trains can be operated at higher speeds and less time is consumed at terminals and in yards.
4. Operation where the use of steam is impossible or objectionable, as in long tunnels.
5. Independence of weather conditions, since the electric locomotive is not affected by cold weather.
6. More reliable operation, as proved by the statistics of all existing electrifications.
7. More effective use of all rolling stock, due to more expeditious movement of traffic.

These are some of the advantages that are now being obtained from the mere substitution of the electric locomotive for the steam locomotive, but they by no means tell the whole story.

Since the United States has an abundance of coal, railroad electrification here has been determined solely by local conditions. Passenger terminal problems caused the electrification of the New York Central at New York and the Pennsylvania at New York and Philadelphia. The limitations of the steam locomotive determined the electrification of the Baltimore tunnel on the Baltimore & Ohio, the Cascade tunnel on the Great Northern, the St. Clair tunnel on the Grand Trunk, the Hoosac tunnel on the Boston & Maine and the Detroit River tunnel on the Michigan Central. Examples of electrified railroads with freight as well as passenger service are the Norfolk & Western, the Chicago, Milwaukee & St. Paul and the New York, New Haven & Hartford.

While the other electrifications are successful and interesting, the last three are more properly representative of general railroad electrification. The Norfolk & Western is an example of electrification under the heaviest conditions of freight traffic on a mountain grade. The Chicago, Milwaukee & St. Paul has in operation the longest continuous mileage in the world and when completed will cross five mountain ranges. The New York, New Haven & Hartford has a very large movement of both freight and passenger traffic. All three installations are successful and profitable and, when financial conditions are stabilized and the American railroad question settled, it is expected that all three of these systems will extend their electrified service.

In addition there are sections of railroads about the country where the present congestion of traffic or the availability of water power warrants the early adoption of electric power. These possibilities alone promise under normal conditions of finance (as no engineering problems now remain to be solved) extensive activity in the electrification of railroads for many years to come.

Differing from America, European and South American countries, with the exception of England alone, lack an adequate supply of fuel, but many of them, including Norway, Sweden, Switzerland, Italy, Spain and Brazil, have large amounts of water power while France has a moderate amount. These resources combined with the high cost of fuel make extensive railroad electrification in these countries inevitable sooner or later.

The neutral countries will probably be the first to undertake this work, Switzerland having a program covering a term of years well established, while both Norway and Sweden are giving active consideration to definite projects. In England a considerable amount of electrification is in contemplation along with the general plan for the electrification of industry. A French commission, composed of government and railroad engineers, has already visited the United States in order to thoroughly familiarize themselves with American practice. The Italian Government will continue its definite program as soon as financial conditions permit. An official Belgian commission is already planning to rehabilitate with electric power at least a portion of the railroads destroyed by the Germans. In Spain, Brazil and South Africa as well railroad electrification is under active consideration.

It is evident, therefore, that the next decade will see a large amount of railroad electrification in almost every quarter of the world.

Editorial Comment

The Coal Issue and Ultimate Issue

FOR MORE than thirty-five days the bituminous coal miners have been on strike. The rate of coal production throughout the country is about 35 per cent of normal. Only because of vast stores of coal in storage have the nation's industries and our national life been able to continue their usual course and each hour brings nearer the time when the supply of coal on hand will be consumed.

In recommending a wage increase of 14 per cent, Dr. Garfield stated that such a wage increase could be awarded the miners without increasing the cost of coal to the public. But this was not his only recommendation. He asked that the miners return to work while a Federal investigation of the entire coal industry be taken up. His wage increase of 14 per cent was not final; it was but temporary. Dr. Garfield's finding was not offered as the permanent solution to the problem, but merely as a palliative that would enable the nation's coal to be mined pro tem, until such time as a thorough investigation would enable a solution at onc equitable and wise to be formulated upon actual facts.

But the miners refused to work. Instead they decided to fight. Apparently they are out for all they can get, regardless of how gotten, or how the nation may meet their demands, or the hardship and suffering capitulation to their demands entails. In this crisis the American people are showing admirable *sang-froid,* typical of our best traditions. Hardship is, however, already being suffered by many, and culmination of the deadlock is not yet in sight. But America must keep her sang-froid, and become cold, if necessary, for a little while, for the issue before the nation will decide who it is that rules the nation.

The miners have thrown down the gauntlet, determined to fight our government for their demands. The issue is thus no longer whether miners are justified in obtaining more money, shorter hours, steadier employment or better working conditions, for Dr. Garfield has promised to determine these things, and on the findings recommend not "what the traffic will bear" but a just and equitable award. The issue between America and the miners now is whether America is to be ruled by those elected by the people to govern them or whether a certain class, representing a very small minority of the people, shall dictate terms and force its will upon the nation regardless of our government and any other element of society.

The issue before us is plain. The immediate issue is whether this country shall be coerced, domineered and browbeaten by a few wilful men who attempt to dictate to a hundred million free people that half a million may obtain their own ends. This is the issue every true American faces today. It is an issue that can no longer be side-stepped. It is an issue that must no longer be shirked by anyone an American in fact as well as name.

We must now decide whether our present form of government shall stand, or whether we shall capitulate to the ultimatum of the self-appointed few to force their will upon us, by ruthless methods, and thus create a precedent that may ultimately result in the overthrow of our present form of government.

Sentiment Versus Logic in the Electrical Christmas Appeal

ALL DECISIONS in life are either the result of sentiment or of logic. Everyone prides himself in being logical in all his decisions, yet in reality most decisions in life are the result of sentiment.

There was only one nation that went into the recent war for purely logical reasons. It was Germany. America went into the war for a sentimental reason—"To make the world safe for democracy." Cool-blooded logic on the part of Germany failed to win the war.

Let us now consider why the middle class of today—largely composed of the former poorer classes—are buying higher priced goods. It isn't because of logic, for logic shows that they should be contented with the class of goods they were accustomed to before, or merely a slightly better grade, as labor cannot logically hope for the present high wage scales to continue. These people, and most people, buy the higher grades of goods, labor-saving devices, electrical table utensils, near luxuries and luxuries for but one reason—sentiment—in the form of pride, love for one's wife, love for the home, the desire for an element of refinement, etc.

They are not interested so much in how much it costs to make coffee in an electric percolator nor its cost, if apparently within the range of their pocketbooks, but in the air of refinement it will give the home, how well it will look on the table and how much it will please the housewife.

Similarly in the case of washing machines and vacuum cleaners. Bridget, who married the milkman, is now on easy street. For sentimental reasons both she and her husband want the washtub and the broom forgotten. Similarly Bridget's former mistress for sentimental reasons wouldn't think of using Bridget's old washtub and broom. It is beneath her dignity to use or handle such things. Logic shows that if the hands are toughened and muscles strengthened this is good from a physical point of view. But neither

Bridget nor her former mistress nor the husbands of either are really logical. For sentimental reasons all prefer the modern labor-saving devices.

Too many advertisements overlook the power of sentiment, yet the good salesman recognizes sentiment as one of the most potent factors in a sale. In the first place, he does all he can to cause his prospect to take a fancy to him, then he learns his hobbies and tries to talk about them, whether the hobby be golf, dogs or baseball, and finally ends the interview with a little selling talk and an order. This isn't, of course, how all sales are made but it is the easiest and quickest way of making a sale.

In advertising, as well as in selling, sentiment must be taken into consideration. Sometimes it should be subordinated to logic. In other cases logic should be subordinated to it. Sentiment has been too far subordinated in much electrical advertising. A common percolator on the stove will make as good coffee as an electric one on the table—but it doesn't make the same sentimental appeal as does an electric one.

Christmas is a sentimental period. The emotion, the desire to give and to please hold sway often to the extent of one spending much more than he can logically afford to spend on presents.

Let sentiment play a part in your Christmas advertising and selling. Appeal to the sentiments of love of wife, of mother, of home and to the sentiments of pride, of desire for refinement, for progress, etc. What more striking appeal could be made at Christmas time than that used by a well-known central station, "Do you love her?" A man does not seek to please his wife or any one else as a rule for logical reasons but for sentimental reasons.

Oil as a Peak-Load and Emergency Fuel

CONSIDERABLE has been said of late regarding the relative values of oil and coal as fuel. The oil men have been very active in furthering the use of oil for industrial and domestic purposes ever since coal became a high-priced commodity and sometimes a scarce one. How does the use of oil fuel in any way affect central stations located in territory where neither gaseous nor liquid fuel are obtainable without considerable transport, in fact in the coal zones?

What are the advantages of oil over solid fuel? The calorific value of oil is about 35% higher per pound than coal; for a given storage space about 50% more heat value can be stored as oil than as coal. Oil is more easily handled than coal, dust and ashes are absent, resulting in lower investment in equipment and smaller labor costs. As to combustion, oil enables fires to be lighted instantly, and instantly shut down, smoke is practically eliminated and combustion may be made more nearly perfect with less trouble than when burning coal. Control of combustion, hence more constant steam pressure and efficiency, are easier when consuming liquid fuel than solid fuel in the lump state. These advantages are very real ones, and yet even when considered upon a basis of investment cost and cost per thermal unit, oil fuel cannot threaten the use of coal with many central stations, because there are other factors involved.

However, while the probability of fuel oil usurping coal must continue to be the exception rather than the rule it would seem that there exists an application for fuel oil among the central stations that might be a very promising one for the oil salesmen to take up. That application is for emergency and peak-load service. Used in this way, primarily, oil fuel would affect considerable fuel saving since banked fires and large stand-by losses would be much reduced, emergency starting would be much more rapidly attained, and the capacity of existing equipment could be considerably augmented.

It is not proposed that oil-burning furnaces and boiler should be available, awaiting the peak demand or the emergency to arise. But we do believe that the use of oil under double-fired boilers so that the oil might be turned to supplement the coal firing whenever needed, would add immensely to the flexibility of operation, likewise the economy. With many, it may be said most, installations, it is the rate of coal burning that limits the capacity of a unit rather than the ability to evaporate water. The addition of oil burners to one or more existing stoker installations would extend this limitation. When the peak load abated or the emergency passed, the oil would be turned off and its consumption immediately cease.

Underfeed stokers are able to bring a boiler up to high rates of steaming in very short time, and sufficiently quickly for central-station purposes and the welfare of the furnace lining, hence the even better performance of oil fuel in this respect is of limited capitalization. But it is the ability to reduce to an absolute minimum the consumption of coal for banked fires and similar stand-by service, that oil fuel offers advantages. Moreover, the use of oil burners in addition to stokers extends the limits constituted by ability to consume coal, hence increases the steam generating capacity of existing equipment while also adding to the flexibility and economy of the plant as a whole.

The above generalities have been dwelt upon in the idea that there may be an application of fuel oil in many a central station if employed as above, whereas if not so used there is no application. By this we mean that central stations located within reasonable distance of sources of coal will find coal their chief source of combustible for many a year to come. It is beneficial that they should, for fuel oil is being used at a rapid rate and there are many instances where exists little choice other than fuel oil. Most central stations are best able to burn coal efficiently, and therefore should stick to the use of coal. Leave the oil for the steamships, the battleships and the plants where coal cannot be readily obtained. But use it when its use is indicated or promising.

Current Events

Light and Power Curtailment Necessiated by Coal Shortage—Water-Power Development for California and Alaska

PUBLIC UTILITIES AFFECTED BY COAL-SAVING PLANS.

Drastic Measures Enforced by Federal Fuel Administration in Effort to Economize on Coal Used by Central Stations.

With the settlement of the strike of the bituminous coal miners remaining indefinite and with the depletion of stocks of coal held in storage by central stations, the situation became such this week that the Federal Fuel Administration issued an order to the effect that in the release of coal to public utilities the latter shall, in furnishing power to manufacturing plants which purchase power produced by use of coal, curtail service to place such plants in the same situation as if they were using coal. This order affects all central stations throughout the United States and as a result unnecessary expenditure of coal has been curtailed also by dimming street lights, cutting off electric signs, show-window lights, etc.

The situation in eastern states has not become alarming, as far as the central stations are concerned, because of large storage of bituminous coal and of the availability of anthracite coal. There are numerous hydroelectric plants in New England and other eastern states which are able to supply much of the demand for power in industrial centers.

However, in middle western states, especially in the northern part, the situation is becoming acute. The public utilities in Chicago and other middle western cities have but a few weeks' supply. Furthermore, if the coal strike should be settled at once it would be several weeks before the fuel shortage could be relieved by fresh deliveries. Because of these conditions drastic measures were deemed necessary by the Illinois State Public Utilities Commission, and as a result it issued the following order to all public utilities subject to its jurisdiction:

"To immediately cease furnishing service for all unnecessary interior and exterior illumination, including signs, display lights and show windows.

"To permit service to shops, industries, business establishments and warehouses (except cold storage) for but 6½ hours per day; provided, where there is continuous operation such service must be discontinued for two working days each week.

"To permit service to retail stores in the central district of Chicago from 11 o'clock a.m. to 5 o'clock p.m. only, and in the outlying districts from 10 o'clock a.m. to 6 o'clock p.m., and until 9 o'clock p.m. on Saturdays.

"To permit service to offices, banks and other places of business, including office buildings, from 9 o'clock a.m. to 3:30 o'clock p.m. each day.

"To permit service to theaters and similar places of amusement for six performances each week, one in the afternoon and five in the evening, without restriction upon motion picture houses."

The Commission earnestly urged upon the public the necessity of co-operating in every way possible to make this order effective, and expressly urges upon domestic consumers of electricity the importance of reducing their consumption of the same to the very lowest point possible, lest there be none for their necessities within a very short time.

Representatives of the Fuel Administration in Chicago ordered the Commonwealth Edison Co. and the Sanitary District of Chicago to cease supplying energy to nonessentials, and the Sanitary District, which operates a hydroelectric plant, was ordered to deliver to the Edison company any surplus power gained by the restrictions on supply of energy to nonessential industries.

The coming of cold weather has reduced the output of hydroelectric plants in north central states, and this, coupled with the fact that very little coal is being moved by the railroads and only a small percentage of that released to the public utilities, makes the sitnation alarming for central-station companies. Unless the strike is settled soon, even more drastic measures concerning the generation and distribution of electrical energy probably will be taken.

A. I. E. E. MEETING TO BE HELD AT CHICAGO JAN. 9.

Electrical Distribution for Street Lighting to Be Considered in Three Papers.

A national meeting of the American Institute of Electrical Engineers has been arranged for Jan. 9, 1920, at Chicago. The general subject of this meeting is to be "Electrical Distribution for Street-Lighting Purposes." There will be two sessions, afternoon and evening. The morning of Jan. 9 will be devoted to registration, getting together, Board of Directors and committee meetings of various kinds, the Western Society of Engineers' rooms in the Monadnock Block being the headquarters.

The first session will be at 2 p. m., at which the following papers will be presented:

"Series Systems of Distribution for Street Lighting," by W. P. Hurley, of the Westinghouse Electric & Manufacturing Co.

"Multiple Systems of Distribution for Street Lighting," by Ward Harrison, of National Lamp Works of General Electric Co.

At 6 p. m. there will be an informal dinner at the City Club.

At 7:30 p. m. the evening session at the City Club will be opened by an address by Dr. Charles P. Steinmetz on "Constant Potential-Series Distribution for Street Lighting." After this address an extended discussion of this subject is being arranged. As a number of modifications of the old series and multiple systems of distribution have been devised recently for meeting the changed conditions brought about by the

new types of street-lighting lamps, it is anticipated that this discussion will bring out much of interest.

The Chicago Section of the Illuminating Engineering Society and the Electrical Section of the Western Society of Engineers will join in this meeting. Local arrangements for this meeting are in charge of J. R. Cravath, of Fowle & Cravath, Monadnock Block, Chicago.

N. E. L. A. COMMITTEES ON WATER POWER AND CO-OPERATION.

Strong and Influential Personnel of These Committees and Outline of Their Work.

President R. H. Ballard of the National Electric Light Association announces that the Committee on Water Power Development under the chairmanship of Franklin T. Griffith, president of the Portland Railway, Light & Power Co., Portland, Ore., will include the following personnel:

William A. Brackenridge, president, Southern California Edison Co., Los Angeles; John A. Britton, vice-president and general manager, Pacific Gas & Electric Co., San Francisco; H. T. Edgar, president, Mississippi River Power Co., Keokuk, Iowa; G. C. Egbert, consulting engineer, Niagara Falls Power Co., Niagara, N. Y.; Mortimer Fleishchhacker, president, Great Western Power Co., San Francisco; H. I. Harriman, president, New England Power Co., Boston, Mass.; D. L. Huntington, president, Washington Water Power Co., Spokane, Wash.; H. F. Jackson, president, Sierra & San Francisco Power Co., San Francisco; Frank M. Kerr, vice-president and general manager, Montana Power Co., Butte, Mont.; W. S. Lee, chief engineer, Southern Power Co., Charlotte, N. C.; A. W. Leonard, president, Puget Sound Traction, Light & Power Co., Seattle, Wash.; J. D. McKee, vice-president, California-Oregon Power Co., San Francisco; G. W. Talbot, president, Pacific Power & Light Co., Portland, Ore.; A. B. West, vice-president and general manager, Southern Sierras Power Co., Riverside, Cal.; A. G. Wishon, vice-president and general manager, San Joaquin Light & Power Co., Fresno, Cal.

A complete investigation of the water-power resources of the country, both developed and undeveloped, will be undertaken by this committee. The great aid to national industrial and agricultural development that will result from commercial and economic use of the nation's natural resources in water supply will be fully set forth for the benefit of the industry at large, bankers and investors. A study will be made respecting the practical application of pending national legislation on the subject and of the economic advantages to be obtained through a more general interconnection of water-power systems.

President Ballard also announces that the following is the personnel of the Committee on Co-operation in the Industry:

Chairman, Lee H. Newbert, Pacific Gas & Electric Co., San Francisco; vice-chairman, Robert Sibley, editor, *Journal of Electricity*, San Francisco; John J. Gibson, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.; D. R. Bullen, General Electric Co., Schenectady, N. Y.; S. M. Seelman, Jr., Brooklyn Edison Co., Brooklyn, N. Y.; R. S. Hale, Boston Edison Co., Boston, Mass.; William Creighton Peet, Peet & Powers, New York City; Frank Price, Pettingill-Andrews Co., Boston, Mass.

This committee is formed to investigate generally conditions throughout the country, and particularly within geographic sections, in regard to the matter of general co-operation in the industry, and will be prepared to make a report and some general recommendations at one of the sessions of the annual convention to be held in Pasadena, May 18 to 21, 1920.

INDUSTRIAL ECONOMICS DISCUSSED AT CHICAGO MEETING.

Chicago Sections of A. I. E. E., A. S. M. E., I. E. S., and Electrical Section of W. S. E. Hold Joint Meeting.

Three papers dealing with various phases of industrial economics were presented at a largely attended meeting of the Chicago Sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and Illuminating Engineering Society with the Electrical Section, Western Society of Engineers, held in Chicago on Nov. 24.

Edwin D. Tillson, testing engineer, Commonwealth Edison Co., took as his subject, "Reaction of Labor to Intensive Lighting." The progress of good factory lighting has been comparatively slow, although if plant owners realized what high financial returns the investment in this line brings they would quickly insist on it. Chicago tests on the productive value of intensive factory lighting showed returns of up to 700% on the investment involved. Many installations of such lighting have been made under the guidance of the Edison company's engineers; in these the intensity has been increased all the way from 3 or 4 up to 50 times the original intensity. Such installations have been carefully designed on basic data and principles derived from numerous tests and well known authorities, and after a detailed survey of the premises has been made. Tests of productive value of lighting are very difficult to make, but two schemes have been proposed by the Lighting Sales Bureau of the National Electric Light Association whereby fairly reliable data on this point will be obtained under varied conditions.

Higher intensity is not the only desirable feature of a good factory lighting system; much more uniform light distribution and absence of dense shadows are of almost equal importance. Under drop-cord lighting now slowly becoming obsolete the workman had a very small brightly lighted area surrounded by a wall of deep darkness that acted like a physical obstruction to his effective and efficient work, and that led to many accidents. Removal of this wall of darkness by provision of good general lighting has a very remarkable effect in making the workman more alert and attentive and much more efficient in every way. By means of a cleverly contrived working model of a factory, Mr. Tillson showed the difference in illumination and in shadows of drop-cord lighting and two systems of general lighting having average intensities of 4 and 12 ft-cdls. on the working plane.

George H. Jones, power engineer, Commonwealth Edison Co., read a paper on "Central-Station Power as a Means of Effecting Economies and Increasing Production." He showed that it is now, especially in view of the coal situation, just as necessary to conserve our resources and eliminate waste as it was during the war. In doing this electric power is a vital factor in many ways as was so effectively demonstrated in the war. Valuable economies result from the logical machinery arrangement and freedom from

much shafting and belting permissible when electric power is used for machine drive, and yet these are not its most important advantages when the power is supplied from a central-station system. During the war we submitted gladly to lighting and heating restrictions in the effort to conserve fuel, but the saving thus effected was small in comparison with that resulting from replacing isolated plants with central-station service.

The marked economies of central-station power supply were strikingly shown in a number of curves, the first showing that the annual output of the Edison company in kilowatt-hours has increased several times as fast as the investment in its entire system, also much faster than the total number of its employes; other curves showed the marked reduction in coal consumption per kilowatt-hour generated by the company and the decreased rates for power, both being due to the much higher efficiency of generation in very large, modern power stations. Mr. Jones cited by contrast the very low economy of the average isolated plant; even well operated and maintained plants of this type often use 10 to 12 lbs. of coal per kw-hr., which is almost a criminal waste of fuel. During the summer the Edison company took over the supply of electric power to ten such isolated plants, enabling their steam equipment to be shut down with a saving per season of some 13,000 tons of coal or enough to supply the entire neighboring city of Evanston for about 15 months.

Harold Almert, consulting engineer, Chicago, presented the third paper, which dealt with the "Personal Efficiency of the Employe." He called attention to the heavy exodus of alien workmen going back to native lands. This and the dearth of immigration for many years have depleted our labor supply very seriously. If we are to get the same output from the remaining workmen we should have increased efficiency from each one of them. During the war the idea of service to the nation spurred everyone on. Now, on the contrary, the spirit of service seems to have vanished and instead we see nearly everyone trying to work less and yet get more pay. Increase in the standard of living is desirable, but it must be kept in bounds to prevent further excessive increases in the costs of commodities.

Mr. Almert cited public utility service as having increased in price probably less than nearly all other services or commodities. And yet analysis of the labor costs of public utilities shows a decided slackening of effort on the part of employes since signing of the armistice. During the present year not only have the wages of such employes gone up, but the time necessary to complete a unit quantity of work has increased, in many cases over double that during the war. Figures were given on the setting of telephone poles, installing telephones, erecting gas holders, etc., which verified this evident decreased efficiency of the employe and which is largely to blame for our increased costs. It is well to provide machinery, power and lighting to increase the efficiency of the plant, that is, the output per employe, but the personal efficiency of the employe must not be allowed to drop further to offset these other gains. Mr. Almert thought that if the workmen were left free from false leadership and agitators, they would return to war-time efficiency. Meantime the employers must make a closer study of human nature, make better selection of his employes and try to stimulate interest in their work by means of profit sharing or other methods that impress on them their obligation to co-operate in meeting the wants of the community.

SOUTHERN CALIFORNIA EDISON CO. TO SPEND $41,800,000 ON WATER POWERS.

Will Build New and Extend Present Hydroelectric Plants Within Next Four Years, Thus Conserving About 2,560,000 Barrels of Oil Annually.

The Southern California Edison Co., with headquarters in Los Angeles, has been authorized by the Railroad Commission of California to sell $7,500,000 of 6% 25-year bonds. Of this amount all but $1,843,000 is to be used to carry out part of the company's construction program, which calls for an expenditure in the next four years, for new water-power plants and extensions, of $41,800,000. The balance is to be used to meet notes issued in connection with construction work now under way. The company has issued a statement to the effect that the proposed new water-power plants will produce electrical energy that would require the burning of 2,560,000 bbls. of oil a year if generated by steam. The statement further declares that approximately one-half of the new power will be needed for electric pumping plants for the irrigation of lands in southern California, the number of acres being estimated at 370,000. In a supplemental order issued by the Commission the Edison company has been granted authority to exchange $1,970,000 of its 1915 debentures at par for $1,970,000 of series of 1919 bonds at 97.

WIRE CONTROL COSTS GOVERNMENT FOURTEEN MILLION DOLLARS.

Deficit Between Net Earnings and Guarantees Was More Than 20% During Government Operation.

War-time operation of telephone and telegraph systems of the country cost the Federal Government $14,418,237, according to the report of Postmaster General Burleson transmitted to Congress on Nov. 13 by the President. The sum represents the difference between the net earnings of the companies and the compensation guaranteed by the Government. Figures showing the result of the operation of the cable companies, which were under Federal control during six months, were not included in the report because reports from these companies had not been received when the postmaster general made his report.

Total net earnings of the telephone and telegraph lines during Federal control were reported at $70,387,532, while the compensation assured was $83,055,769. The total deficit included an estimated $3,000,000 for settlement of future claims. Small independent companies operated by the Government reported a surplus of $57,428.

HYDROELECTRIC DEVELOPMENT PROJECTED IN ALASKA.

Nonfreezing Mountain Springs to Furnish Power for Operation of Gold Dredges at Nome.

Plans, tentatively outlined two years ago, for the development of hydroelectric power on the north slope of the Sawtooth mountain range, on Seward Peninsula, Alaska, apparently are being completed for

New York men who are interested in the project. The source of water for power is in springs on the mountainside which do not freeze in winter. In this flow there is a fall of about 700 ft. This water runs into the Kuzitrin river, the latter into Salt lake, which has an outlet into Clarence bay.

It is understood that two 5000-hp. generators, as the initial units, may be installed in 1920, and that the project contemplates other similar-sized units. The first installation, it is reported, will require a 56-in. pressure pipe two miles in length, and a transmission line to Nome, a distance of about 80 miles. The principal market for power is for the operation of gold dredges on the Nome tundra and elsewhere on Seward Peninsula, concerning which plans on a large scale are being considered.

PACIFIC GAS AND ELECTRIC TO TAKE OVER ANOTHER UTILITY.

Proposes to Operate Sierra & San Francisco Power Co.'s Plant and Transmission Line for 15 Years.

The Pacific Gas & Electric Co. has completed a preliminary agreement with the Sierra & San Francisco Power Co. to lease and operate all the properties of that company for 15 years. Application being made to the California Railroad Commission for permission to complete the agreement, according to a statement made by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Co. The principal properties and power house of the Sierra & San Francisco company are in Tuolumne county, and it owns a transmission line to San Francisco, where it supplies the United Railroads and Universal Electric & Gas Co. with power. The company also owns a distribution system in the San Joaquin valley and operates in Stanislaus and Calaveras counties. The proposed lease will enlarge the facilities and equipment of the Pacific Gas & Electric Co. Should the Railroad Commission rule favorably on the matter, the Pacific Gas & Electric Co. will, it is stated, make improvements that the Sierra & San Francisco Power Co. has had under consideration and probably will also make some extensions.

DEVELOPMENT OF ELECTRICAL SIGNALING DURING THE WAR.

Dr. Jewett Reviews Progress in Communication and Signaling—Address Before Seattle Section, A. I. E. E.

Dr. F. B. Jewett, chief engineer of the Western Electric Co., made the principal address at a well attended meeting of the Seattle Section of the American Institute of Electrical Engineers at Seattle, Wash., on the evening of Nov. 17. His address related to the development of means of communication for the army and navy during the war, in which special attention was given to use of the telephone at the battlefront, radiotelephony and radiotelegraphy for both army and navy. He illustrated and described submarine detectors and instruments for sound ranging of big guns. He also explained the apparatus developed whereby pilots on several airplanes had successfully communicated with each other and with stations on the ground. This had proved a success in cases where visual signaling was impossible. He exhibited numerous lantern slides and motion pictures of the highest interest.

During the war Dr. Jewett was a lieutenant colonel of the Signal Corps, and had a directing hand in developing radiotelephony to its acknowledged efficiency in military and naval service.

AUTOMATIC TELEPHONES FOR NEW YORK CITY.

The New York Telephone Co. has announced that following exhaustive experiments it has developed a machine switching central office system that has proved so satisfactory in a number of practical trials as to warrant its use in several places within its territory.

Installations are now being made in Dunkirk, Ithaca and Geneva and the work is expected to be completed about the first of the year. In New York City it is planned to place this apparatus in the three new exchanges, but none of these installations can be completed, according to present estimates, much before the end of 1920. The latter changes are expected to help meet the abnormal demand for telephone service in that city.

The new system has been so carefully worked out and the means of co-ordinating it with the other types of switchboards have been so perfected that the different types of equipment will interconnect without difficulty. In fact, a subscriber connected with one of the new switchboards will not need to know whether the called party is connected to a machine switching or a manually operated switchboard and vice versa.

N. E. L. A. COMMITTEE TO COMPILE FACTS ON LINE DEVICES.

The Overhead Systems Committee of the National Electric Light Association is planning in its 1920 report to bring to the attention of the industry any new devices that, in the committee's opinion, would be useful in line construction or line maintenance work. In order to make the report as useful as possible, the committee would be glad to get into touch with any manufacturers making such tools or devices for use in overhead line work.

It is not the committee's plan to include in its report anything whatever regarding the various lines of standard fixtures that are on the market, but to call attention to special articles that might prove of particular value to operating companies.

Any data regarding such items should be sent to W. K. Vanderpoel, chairman of the Overhead Systems Committee, 80 Park place, Newark, N. J.

N. E. L. A. COMMITTEE MEETINGS SCHEDULED.

The following National Electric Light Association committee meetings have been scheduled during the month of December: Committee on Inductive Interference and Committee on Overhead Systems, Denver, Colo., Dec. 1-3; Committee on Meters, Ft. Wayne, Ind., Dec. 2; Committee on Membership and Committee on Credits and Collections, 29 W. 39th street, New York City, Dec. 3; Executive Committee, 29 W. 39th street, New York City, Dec. 4; Committee on Prime Movers, Pittsburgh, Dec. 8; Committee on Bonus Systems, 29 W. 39th street, New York City, Dec. 10; Committee on Underground Systems, Detroit, either Dec. 15 or 17.

Commercial Practice

Customers Buy Central-Station Stock—Sterilizing Instruments with Electric Heat—Campaign for Window Lighting

CENTRAL STATIONS SELL STOCK TO CUSTOMERS AND EMPLOYES.

Blocks of Stock Offered to Customers and Employes by Commonwealth Edison Co. and Public Service Co. of Northern Illinois.

With a view to increasing the number of local stockholders the Commonwealth Edison Co., Chicago, offered during November a block of 5000 shares of its stock to customers and employes.

The stock was offered at $112.50 (which was a little above the market price), on installment terms, with the initial payment of $5 per share, and subsequent payments of $5 per month per share. Thus the total payments cover a period of 22 months, the payment for the last month being $2.50. The company issued to each customer or employe signing an application and making the required initial payment a stock purchase receipt which contained the terms and conditions of the contract by which the company sold the stock and which provided for indorsement of the payment of the various installments due from the purchaser. When all installments are paid the purchaser will receive a stock certificate for the number of shares covered by the receipt, the stock not being new but that which has been validly issued and reacquired by the company.

So long as no default is made in the payment of any of the installments when due, the purchaser will be credited with any dividends paid on the stock and will be charged with simple interest at the rate of 6% on each installment from date of purchase to the date of payment of such installment. As the dividends have been and will likely be more than 6% they probably will more than offset the interest charge. In case any purchaser fails to pay any of the installments when due, it is provided that the receipts evidencing payment of prior installments will become void and that the purchaser will lose all interest in the amounts paid by him, but he will be entitled to receive an amount equal to the sum for which his stock purchase receipt could have sold upon the market on the day of his default.

Notice of the sale of the stock, which is regarded as a choice investment, was sent out in circular form to the customers of the company. Sales teams were organized among the employes of the company, ten-men teams under the leadership of appointed captains being assigned to each of the 35 wards in the city. A commission of $1 per share was offered to the salesmen for selling the stock, the work being done on their spare time. Rivalry between the different teams was engendered by the offer of cash prizes ranging from $75 for the winning team down to $5 for the fifteenth.

The original offer of 5000 shares was extended, the sales of the 385 salesmen totaling 8747 shares. These were sold to 3714 persons, a maximum of 5 shares to a person being set. The winning team sold 697 shares, while the highest individual sale was 186 shares. The sale was limited to a three-day period, and the returns showed very satisfactory results.

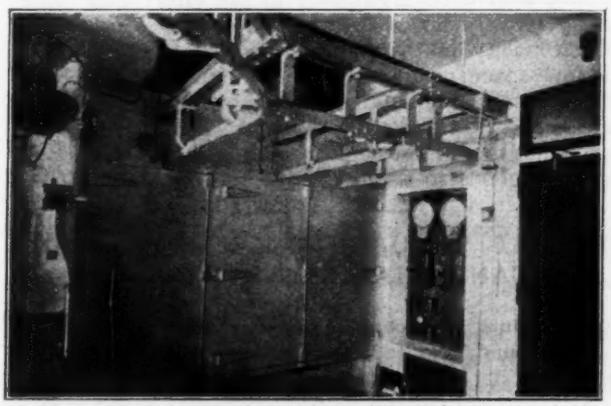
Following the sale of Commonwealth Edison Co. stock comes the announcement that the Public Service Co. of Northern Illinois will offer a block of stock for sale to its customers and employes. The terms, conditions and methods of sale will be somewhat similar to these outlined above, and it is expected that the sale will result in the addition of a large number of stockholders who are customers of the company.

ELECTRIC HEAT EFFICIENT IN STERILIZING INSTRUMENTS.

Gas Oven Supplanted by Electric Oven, Which Proves Superiority in Economy, Efficiency and Simplicity of Operation.

Besides furnishing electrical energy for power, heat and light, central-station companies have taken upon themselves the duty of investigating and becoming familiar with the thousand and one uses in which electricity has been found economical, efficient and satisfactory.

A noteworthy case of this kind was brought to light by the Boston Edison Co. in connection with the Forsyth Dental Hospital, Boston. This institution treats daily the teeth of some 300 to 400 children.



Electric Oven for Sterilizing Dental Instruments.

In a hospital, sterilization is the watchword and as a result it is necessary to properly sterilize 300 to 400 sets of instruments each day, or practically 21,000 separate instruments. For this purpose a gas-heated oven was originally installed. It was successful insofar as it performed its functions after a fashion, but it proved expensive to operate and hard to maintain temperature control. It also generated moisture which coated the instruments with rust, rendering them useless. If the temperature went above a certain point, which it often did, owing to the failure of the

controlling apparatus, the intense heat "drew" the temper, also rendering the instruments useless. After destroying several thousand sets, it was suggested that the ovens be electrically equipped.

The ovens are now electrically heated, automatically controlled, and perform the sterilization perfectly at a cost of about $48 per month for energy.

The ovens have attracted widespread attention from physicians, hospital authorities and the electrical fraternity, and further application of this method is contemplated in other institutions.

CAMPAIGN BRINGS OUT ADVANTAGES OF GOOD WINDOW LIGHTING.

Contractors and Dealers of Rochester, N. Y., Co-operate with Central Station in Campaign for Better Lighting of Window Displays in That City.

The industrial department of the Rochester (N. Y.) Railway & Light Co. is conducting an organized campaign for better show window lighting among the merchants of Rochester. A survey showed that approximately 80% of the window displays in the city were poorly lighted. In order to spread the idea of good lighting the central-station company, in co-operation with the Rochester Electrical Contractors and Dealers Association, decided upon definite plans under which to work.

A list of merchants having poorly lighted window displays was compiled, and circular letters were sent to all on the list inviting them to call and inspect some examples of modern show window lighting prepared by the Rochester Railway & Light Co. These consisted of exhibits of colored fabrics, loaned by one of the department stores, one exhibit being correctly illuminated with modern methods and the other incorrectly illuminated by old methods. At the same time advertisements in the daily papers were used to interest the prospects and other merchants who were not on the list.

Salesmen used arguments to the effect that store managers were slow to realize that $15 a month spent for electricity in maintaining good lighting in their window space meant an increase from 50 to 200% in their sales; also that the public was becoming familiar with well lighted window displays and that merchants should not neglect the opportunity of showing their goods to the best advantage.

PRESENT VALUATION HELD MORE IMPORTANT THAN ONE BEFORE WAR.

Court Grants Injunction Against a Fare Increase on Ground That It Was Not High Enough to Cover Increasing Costs.

Valuation of public utility properties for rate-making purposes cannot be estimated, fairly, on the basis of original costs in a before-the-war period, said the Federal Court of Appeals in a recent case in Kansas City, Mo. Three judges passed on the question. The decision was in the application of the Joplin & Pittsburg Railway Co., for an injunction to prevent the enforcement of the Missouri Public Service Commission's order increasing the passenger-mile rate from 1.93 cents to 2.12 cents. The court held that it could enjoin such increase if it did not go far enough to allow the company a remunerative return. It held that such increased rate was not remunerative, and set a rate of 2.5 cents as a maximum that the company could charge pending further adjustment by the state commission. The court had reviewed the valuation figures as prepared by the commission, and the figures presented by the company. It declared that apparently the commission had laid too much emphasis on the cost of the property before the war, when the railroad was completed. "It cannot be said," the court declared, "that the present period of high prices is so temporary or abnormal that it may practically be disregarded in arriving at the value of the complainant's properties. No one can say what degree of depression may ultimately come, but it is reasonably certain that the cost of the properties now under consideration will never again approximate figures prevailing in the years before the World War."

LOW COST OF ELECTRICITY SHOWN BY FIGURES FROM LOUISVILLE.

The relative cheapness of electric service in households is shown in a striking way in a tabulation recently prepared by Robert Montgomery, commercial manager of the Louisville Gas & Electric Co. Mr. Montgomery shows that it is possible for a five-room cottage to obtain electric service for about one-third the cost of that of 19 years ago, and at a much lower price than before the war. The basis upon which the comparisons are made is a monthly consumption of 50 kilowatt-hours either in a five-room cottage or apartment.

As the Louisville company has an optional rate calling for a price of but 3 cents a kilowatt-hour for all energy in excess of 6 kilowatt-hours per room per month, it is possible to obtain the 50-kilowatt-hours for $2.88. On the ordinary residence rate the monthly bill would be $3.80, compared with $5 in 1910, $8.34 in 1905 and $10 in 1900.

PITTSBURGH COMPANY SETS NEW HOUSE-WIRING RECORD.

Early in the current year the Duquesne Light Co., Pittsburgh, set out to secure 5000 contracts for the wiring of old houses during the twelve-month period. This seemed rather a high mark to strive for, and the progress of the campaign was watched closely by others in the industry, particularly managers of central-station commercial departments. As month after month went by, reports showed that the company was exceeding its quota. The latest information is that on Nov. 10 a total of 4794 contracts for wiring old houses had been secured, and indications pointed to the fact that close to 6000 contracts would be signed before the end of the year.

The campaign is a record-breaking one, and shows emphatically the possibilities that exist in the house-wiring field.

CAMPAIGN FOR PORCH LIGHTING.

The Puget Sound Traction, Light & Power Co. has inaugurated a campaign for the purpose of inducing customers in residential districts to install porch lights for all-night service. The idea behind the campaign is that wholesale use of porch lights will provide protection against burglaries as well as enhance the effectiveness of the street lighting, making the streets of Seattle safer for pedestrians as well as vehicles.

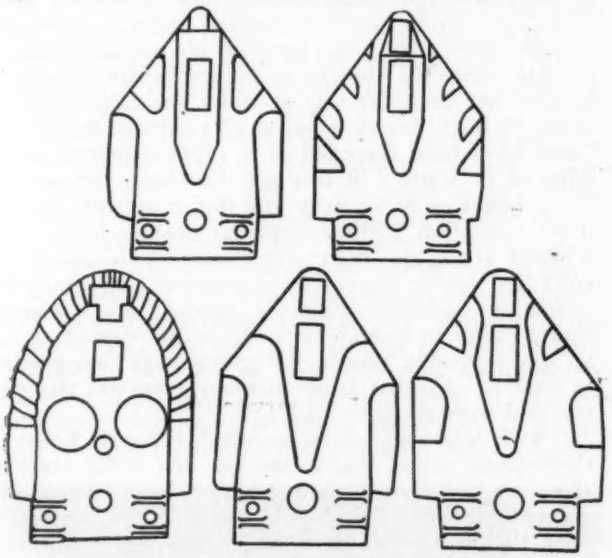
Operating Practice

Influence of Tuyeres Upon Combustion Efficiency—Instrument "Service"—Factors Affecting Underground Cables

INFLUENCE OF CHOICE OF TUYERE UPON STOKER EFFICIENCY.

Interesting Data Obtained by Detroit Edison Co. Clue to Higher Furnace Efficiency and Over-all Economy.

During the year 1918 a decided drop in operating efficiency was found to have occurred at the Delray station of the Detroit Edison Co., part of this decrease being chargeable to the boiler room. Previously, some modifications had been made in some of the stokers, and it was suggested by Mr. Stark of the Delray station that these changes might be responsible for the drop in efficiency. The modifications that had been made to the stokers, of the underfeed type, consisted in changing the type of tuyere originally used by the stoker manufacturer for one designed by the



Different Types of Tuyeres Experimented Upon by Detroit Edison Co.

Detroit Edison Co. Several different designs had been evolved by the company, but because of changing personnel due to the war, complete tests were not run and the new tuyere designs were adopted before determining their efficiency as compared with that of the original tuyeres. It was thought that these might be the cause of less efficient stoker performance.

The original underfeed stokers installed at Delray were Taylors, the tuyeres for which have a front nose of solid cast iron. This nose burns in course of time, and to overcome this a tuyere was designed in 1913 that had the same cross section (5.5 sq. ins.) for the flow of air through it as the Taylor, but so divided that half the air passed through the nose and half through the sides instead of entirely through the sides as was the case with the original Taylor tuyere. This tuyere was called the Delray tuyere. Later on, the Conners Creek tuyere was designed for about 9 sq. ins. of air passages which consisted of eight holes spaced around the tuyere.

The accompanying illustration shows various tuyeres used by the Detroit Edison Co. with its underfeed stokers. The tuyere which has since been found the most efficient, after extensive furnace and boiler tests, is the Taylor tuyere and the one originally furnished with the Taylor stoker. It is the one in the center of the bottom row. The top left-hand tuyere is the Delray type, that on the top right-hand side being the Conners Creek tuyere. The bottom left-hand tuyere is of a well-known make, while the one shown on the right-hand side at the bottom is another tuyere experimented with. The above information was presented by J. P. Considine, Detroit Edison Co., in the October issue of the *Synchroscope*.

COMMON SENSE A FACTOR IN MAINTENANCE OF INSTRUMENTS.

Example of Misuse of Recording Instruments Shows Difficulties of Manufacturers in Maintenance.

It is often stated that "service" after a sale of equipment may mean that the manufacturer is called upon on frequent occasions to repair or maintain some piece of apparatus damaged through misuse or abuse and not through ordinary wear and tear. This form of "service" is a very expensive one for the manufacturers, for which they receive neither credit nor reward of any kind, but instead usually much complaint.

In one case that occurred quite recently in a very large power plant where the personnel had both quality and quantity a large number of recording thermometers had been installed. There were so many of these instruments in use, that it was one man's job to go round daily and wind them up. The time taken for this operation, plus the foot-pounds required to wind the clock mechanism, suggested a time and energy-saving method.

One of the keys for winding the clock had the handle cut off and the shank was then fitted to a brace. The attendant was then able to quickly and easily wind up the clocks. Unfortunately, with the brace, because of the leverage obtained, it was very easy to overwind the clocks, and many springs were broken from this cause. At first, the manufacturer replaced the springs, but as spring failures became quite frequent, broke incessantly, investigation was started to determine the cause, and, of course, a complaint was lodged by the manufacturer with the user as to the manner of winding the clocks. As soon as the brace method of winding was discontinued, the clock springs ceased to break.

This incident has been mentioned to emphasize the fact that the responsibility for using commonsense and discretion rests with the purchaser of equipment for no instrument can be made absolutely foolproof.

PAPER-INSULATED CABLE PROPERTIES.

Considerations Involving Safety of Operation and Life of Underground Lead-Covered Conductors.

Paper-insulated, lead-covered, underground conductors are employed to a greater extent than conductors insulated with varnished cambric or vulcanized rubber.

Impregnated paper will stand higher operating temperature with a lower rate of deterioration than rubber or varnished cambric. It has high dielectric strength and when properly made has reasonable temperature variation curves for insulation and dielectric loss. It has the lowest cost of the three.

Its greatest drawback is its tendency to absorb moisture, requiring a waterproof outer jacket and the careful sealing of ends. It is also the least flexible of the three insulations. It follows that its life and rate of deterioration are really entirely the rate applying to its outer jacket.

As to form of conductor, on account of the saving in material and space, the semi-sector shaped conductor will undoubtedly become standard for all 3-conductor cables with paper insulation larger than No. 1/0. Limiting the over-all diameter to about 3 ins. and limiting the smallest cable by one giving a tension of about 90 volts per mi. at the surface conductor, the present range available is shown in Table 1.

Three-Phase, Paper-Insulated, Lead-Covered Cables.
Y-Connected Neutral-Grounded Circuits.

Working pressure, a-c., r.m.s. Volts.	Insulation on each, ins.	Belt.	Small.	Large.	5-minute test between conductors, volts.	5-minute test to earth, volts.
30,000	11/32	11/64	3/0	3/0	75,000	45,000
25,000	9/32	9/64	1/0	250,000	62,500	37,500
15,000	11/64	5.5/64	2	650,000	37,500	22,500
10,000	4/32	2/32	7	750,000	25,000	15,000

It is self-evident that in selecting the working pressure of a system, the size of the distribution feeders in kilowatt capacity is a most important factor.

The smallest 30,000-volt cable is good for at least 8000 kw. at 100% power-factor under ordinary conditions. It would appear, therefore, that plants with a probable 25,000-kw. maximum output are not justified, except by requirements of interconnection, in going to 30,000 volts unless its feeders are of extraordinary length.

Table 1 refers to cables for Y-connected grounded neutral circuits and some of the reasons for excluding the consideration of the open-delta connection are outlined below:

(1) Maximum kilowatt capacity in given duct with grounded Y.

(2) Minimum cable cost for given kilowatt capacity. If a 3-conductor No. 4/0 15,000-volt cable, 6/32 by 6/32 in. paper cost $1, a 3-conductor No. 4/0 15,000-volt cable, 6/32 by 3/32 in. paper would cost 90 cents.

A comparison of change of voltage and connection:

3-conductor, 500,000 cir. mil.—15,000-volt delta, 325 amp., 8400 kv-a.—about 8 watts per duct-foot loss. Cost, $1.

3-conductor, 350,000 cir. mil.—25,000-volt "Y," 250 amp., 11,000 kv-a.—about 7 watts per duct-foot loss. Cost, 88 cents.

Increased capacity	30%
Decreased investment	12%
Decreased transmission loss	12½%

As to operating, many companies have changed from open delta to improve operation. Almost none have taken the reverse step.

Tests made seem to show that where no voltage stress is present, a temperature of 85° C. does not produce any appreciable deterioration in properly made paper cables in one year. Temperatures of 100° C. maintained for two months produced less than 10% reduction in tensile strength of the paper. These results, of course, apply only to the particular paper and saturating compound used and are not universally true but they indicate what can be done.

If cable insulation were perfect the charging current would have zero power-factor. In practice the power-factor varies from 2 to 6% at 25° C. and from 18 to 50% at 100° C., tests being at operating voltage and 60 cycles. This energy must all go towards heating the cable and when a point is reached where the sum of C^2R loss and the dielectric loss exceeds the amount of energy which can be dissipated, a burn-out must and does result. This is why cable manufacturers object to operating temperatures of 100° C. for short periods and 85° C. continuously.

It follows, therefore, that every size of every make of cable of each voltage rating has a definite safe operating current and temperature under a given set of conditions. It is not possible for a manufacturer to state either the current or the temperature because he does not know the rate at which the cable can dissipate its heat, due to losses at all points of its length. Cases have been recorded of a 12,000-volt line operating at 11 watts C^2R loss per duct-foot, for periods of 12 hours or more daily and this represents an extreme condition without artificial cooling. Probably 8 watts on 13,200 volts and 7 watts C^2R on 25,000 volts are nearer general safe practice. There is, of course, a variation with the season; one company rating cables in conduit with air in the open at 30° F. at approximately double the rating with temperature at 100° F. Another large company increases the winter load over summer load 25%.

With reference to the so-called dielectric losses in three-phase cables, that is, the loss due to the pressure stress in the insulating material independent of the current carried. This loss varies with the frequency, with the square of the voltage (unless insulation is over-stressed), and with the temperature. Power-factor of the charging current varies in the same way and the figures given below outline a very good cable and a very poor one, at 60 cycles, 14,000 volts.

Temperature.	Good cable. Power-factor.	Good cable. Watts loss per duct-foot.	Poor cable. Power-factor.	Poor cable. Watts loss per duct-foot.
20° C.	1%	.05	10%	.5
40° C.	7%	.15	20%	1.0
60° C.	10%	.30	35%	2.5
80° C.	15%	.50	59%	6.0
100° C.	20%	.70	73%	13.0

The poor cable had been in use six years. The watts, of course, will vary with the size of the cable while the power-factor does not increase with the size of conductor. Therefore, even with the best cable allowance must be made for this dielectric loss. The above are excerpts from a paper on "High-Tension Cables," presented by Wallace S. Clark before the New England Section, N. E. L. A.

Contracting-Construction

Repair of Large Alternator—Platform for Overhead Motor —Motor Maintenance Cost Form—Convenient Fuse Rack

REPAIR OF ALTERNATOR HAS INTERESTING FEATURES.

Customer's Specifications Make Difficult Work for Contractor in Reinsulating Stator Coils of Big Alternating-Current Generator.

Instead of giving the customer what he wants, most American business concerns would rather give him the kind of goods and service they think is best for him. This sort of policy has lost a great deal of foreign business for American exporters, and at the same time it has lost business in this country for concerns whose policies are not flexible enough to allow them to place their reliance on the judgment of the buyer.

This fact holds true, in many instances, for the electrical contractor. Of course, there are occasions when the customer is in error to his own detriment, and in order to properly serve him it is necessary for the electrical contractor to offer advice from his experience. But there are times when the customer is right.

An illustration of this point is given in the case of the repair of an a-c. generator in the power plant of Morris & Co., Chicago. The machine in question is a 600-kv-a., 440-volt, 60-cycle, three-phase, engine-type Bullock alternator that has been in service about 18 years. The insulation on the stator coils began to deteriorate and this fall the company decided that it was necessary to repair the machine, reinsulating the stator coils. However, the demand for power nearly equals the capacity of the generating equipment in the plant, and precautions had to be taken so that only one generating unit was out of commission at a time. Accordingly, repairs to the alternator were a matter of speed. Furthermore, the company stipulated that the repairs should be made in the power house and that parts could not be taken to the contractor's shop to be repaired. The reason for this was that the company was afraid that a strike might occur when parts were out of the power house and that such an occurrence might prevent the return of the parts and would endanger the capacity of the plant, especially if one of the other units should fail.

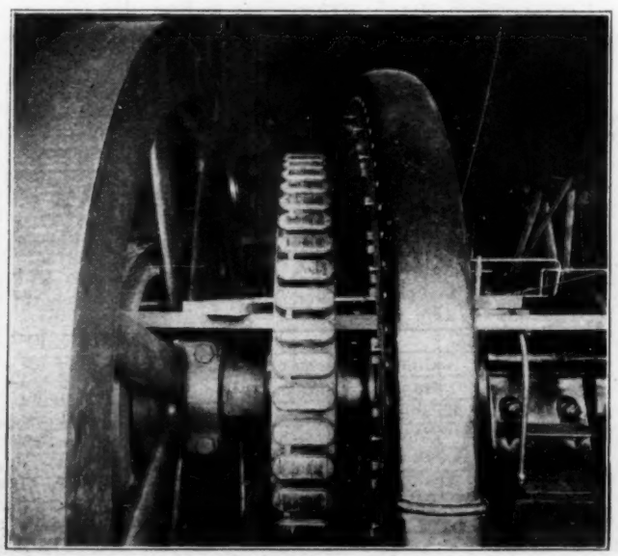
In spite of these stipulations, the work of repairing the alternator was undertaken by the Electric Service Construction Co., Chicago. The stator has 72 poles, made up of 288 coils of ¾-in. by 1/16-in. form-wound copper. These were all removed and found to be insulated with a wrap of linen tape varnished, then a wrap of oiled linen tape, a sleeve of mica, a wrap of linen tape and finally a covering of fish-paper. The coils were soaked in a vat of hot water and lime, the old insulation scraped off and the copper cleaned and wiped.

The coils were wrapped with linen tape, double lapped, and after being dipped in Sterling varnish were placed in a baking oven for 16 hours. Two layers of double-lapped oiled linen tape were then placed on each coil, followed by a wrap of double-lapped linen tape and a sleeve of fish-paper. The coils were then put back into place on the stator frame and the connections soldered in.

Two shifts of 5 men, each working 8 hours, accomplished the work of repairing the alternator in 24 days, which was deemed very satisfactory, considering the amount and nature of the repairs made.

After the repairs were completed the machine was tested at 2300 volts for grounds and then run with 600 kv-a. load for 10 hours without appreciable temperature rise.

Improvised Work Bench Used by Contractor in Reinsulating Stator Coils of Alternator.

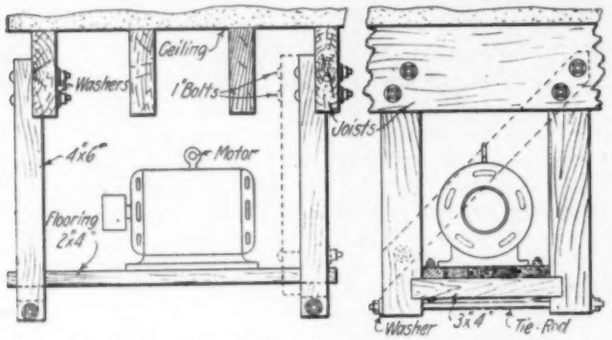


Rotor of 600-kv-a. Alternator Shifted to One Side to Permit Repair of Stator Coils.

CONSTRUCTION OF AN OVERHEAD PLATFORM FOR MOTORS.

By L. M. Harrison.

When floor space is at a premium it may be desirable to mount electric motors on platforms suspended from ceilings instead of supporting them on the floor. In the accompanying illustration are



Construction of Wooden Motor Platform for Overhead Installation.

shown the details of a satisfactory support for motors of capacities up to about 30 hp.

Four 4 by 6 timbers bolted to the floor joists sustain the floor of the support. To these vertical pieces are clamped two 3 by 4 cross timbers, which act as beams to which the 2 by 4 tongue-and-groove flooring is spiked. A 1-in. tie rod binds together the lower ends of the verticals. Where the side pull is great to insure against shifting, diagonal pieces, as shown by the dotted lines, may be used to prevent lateral displacement.

CONCISE FORM FOR KEEPING MAINTENANCE COST RECORDS.

Those responsible for the upkeep and maintenance of electrical equipment often desire accurate data to determine just what each appliance costs in upkeep, labor and spare parts. It is necessary to keep proper records to obtain this information, and for this purpose Mr. Bower, chief electrician of the Berwick (Pa.) plant of the American Car & Foundry Co., has originated a form which is noteworthy because it

MOTOR FORM

TYPE	SERIAL NO	R P M	FIRM	H P	MOTOR NO
G.E.	53954	1040	General Electric	20	1840

P S M FT 2320 NO 8 SIZE OF BRUSH 2½"x 1¼"x ½"

SPARE ARMATURES 1 GRADE 702

REMARKS

Drives fan 1537
Front C & E
Aisle #1

DATE	BRUSH GRADE	REMARKS	CHECK NO.	HRS	RATE	COST
7/15/19		Changed armature	2949	6	60	$3.60
"		Repaired commutator	2847	2	65	1.30
7/18/19	5-702					1.60
"		Changed brushes	2949	½	60	.30
7/19/19	1-60					.05
7/24/19	1					3.00
"		Changed bearing	2949	2	60	1.20

Form for Keeping Records of Maintenance Costs of Motors and Other Electrical Apparatus.

can be kept up easily and at the same time give essential maintenance costs.

The accompanying illustration shows the form and in this particular instance is applied to data on maintenance costs of a motor, although it is suitable for practically any type of electrical apparatus on which such costs are desired.

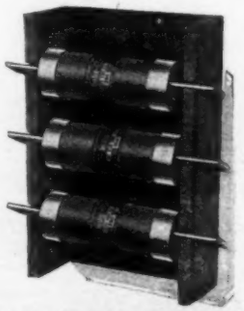
ELECTRICIAN'S LICENSE LAW DISCUSSED.

At a meeting of the Massachusetts State Association of Electrical Contractors and Dealers, held Nov. 20 at Boston, F. A. Williams, clerk of the State Board of Examiners of Electricians, read a paper on the license law passed in Massachusetts in 1915, giving facts and figures regarding the law from its inception up to the present time.

Since that time 3912 examinations have been made, or an average of about 100 a month. The last six months the average examinations were 114, while the month of November will probably show 250 examinations. There are at present about 8000 journeymen electricians licensed and 700 masters. Since 1915 there have been 3000 licenses lapsed, a large majority of these were journeymen. Mr. Williams told of many cases where men were arrested for disobeying the law and spoke of the proposed legislation to more fully fortify the law. He requested the co-operation of the contractors in the coming proposed legislation.

FUSE RACK SAVES TIME.

Maximum production is what is demanded of manufacturers these days, and when production depends on electric motive power, any device that will help shorten the time of stoppages has merit. In order



Handy Rack for Extra Fuses.

to avoid delay as much as possible extra fuses should be kept handy near every motor.

A convenient and practical method is to build a wooden rack like that shown in the accompanying illustration. It should be installed near the motor and accommodate an extra set of fuses, of correct rating, so they will be available immediately a fuse is blown.

NEW YORK CONTRACTORS AND DEALERS HOLD MEETING.

The regular semiannual meeting of the Metropolitan District Association of Electrical Contractors and Dealers was held in New York Nov. 24. In addition to reports of officers covering the activities of the association for the current fiscal year, the report of the secretary covered the work of the license board and the elimination of special permits. Addresses were delivered by W. L. Goodwin and Samuel A. Chase.

New Appliances

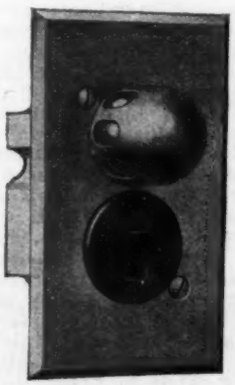
Compact Wall Receptacle and Pilot Light—Double Toggle Switch for Automobiles—Magnetically Operated Oil Switch

Combination Receptacle and Warning Light for Single Switch Box.

It is a recommendation of the National Electrical Code that in connection with smoothing irons, sadirons and other heating devices intended to be applied to combustible articles, there should be a warning signal to indicate that the current is flowing. Compliance with this recommendation has been rather slow because of the nature of the fittings available for the purpose. These were expensive in first cost and were also expensive to install because of their size, some of them requiring a two-gang box, but most of them a three-gang box.

The Bryant Electric Co., Bridgeport, Conn., just placed on the market a device which is a combination of its standard Spartan flush receptacle and warning light. The two are combined in a single porcelain which can be installed in a single switch box. The Spartan receptacle will receive any of the numerous Spartan and other standard parallel-bladed caps. The 2-cp., 125-volt candelabra-base warning lamp, which is connected in parallel with the receptacle, is protected from mechanical injury by a perforated brass cage. When occasion requires, the lamp can be renewed by removing the faceplate of the device. The connections in the receptacle are such that the lamp automatically lights up when the attachment-plug cap is inserted, thus doing away with the necessity of a snap switch which is frequently a component part of devices designed for the purpose.

The use of a device of this kind is not only advisable from the fire-prevention



Combined Wall Receptacle and Pilot Lamp for Flatiron and Similar Outlets.

standpoint but also from the standpoint of economy in connection with the less hazardous but widely used domestic appliances, such as percolators, toasters, chafing dishes, curling irons, etc., since it tends to diminish the unintentional and undiscovered consumption of current. All internal connections are made complete at the factory so that the device can be substituted for any receptacle at present installed by simply attaching the line wires to the two terminals that are provided. The new device is designated by catalog No. 121.

Two-Gang Toggle Switch for Automobiles.

Harvey Hubbell, Inc., Bridgeport, Conn., has just brought out a new type of two-gang switch for automobile use generally, but perhaps more especially adapted for closed-car interiors. It is in the popular toggle pattern and so designed that the handles are countersunk

New Toggle Switch for Automobiles—Handles Countersunk in Recesses.

in gracefully curved recesses which add materially to its artistic appearance. Several of the leading automobile manufacturers have already adopted this switch for their car bodies. This new type will be listed as the No. 8022 switch.

Oil-Immersed Switch Operated by Clapper-Type Magnet.

Magnetically operated main-line switches on alternating-current light and power circuits are at times slow and unreliable in closing when a solenoid and plunger must be depended upon for their operation. If the plunger is slightly out of adjustment its movement becomes jerky and noisy, its sealing pull is diminished, and it does not seat properly.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has developed a new oil-immersed magnetic contactor, operated by a clapper-type magnet, which makes possible a more rigid mechanical structure and greater reliability in operation than is obtained in contactors of the solenoid and plunger type. This contactor has a capacity of 100 amperes at 2200 volts, and is particularly desirable as a main-line switch for an automatic 2200-volt motor starter, or for the remote control of any 2200-volt light or power circuit. It is built with three poles, unless used with an auto-transformer starter when five poles are provided.

The frame of the contactor, which is of heavy sheet iron, is arranged for wall or switchboard mounting, and carries two cast-iron supports with two insulated shafts carrying the contacts. The copper leaf brush contacts are saved from all wear due to breaking the circuit because auxiliary arcing contacts are provided for this purpose. Leads from the contacts connect with suitable terminals extending through high-tension insulators mounted on the top of the frame. The armature is firmly pivoted to the frame, and is connected by a rod to an arm of the shaft carrying the moving contacts. The attraction of the armature against the face of the magnet rotates the shaft and closes the switch, which is normally held open by the weight of the moving parts.

A good head of oil is maintained over the contacts by providing a sheet-metal tank of ample capacity, and as the contacts are situated above the operating shaft they are away from any sediment which might accumulate in the bottom of the tank. The arc is broken at the contacts in a horizontal direction and therefore rises to the point of rupture without burning other parts. Transite shields prevent arcing across adjacent poles.

This new oil-immersed switch may be arranged to have two contactors act as a reversing switch, in which case they are mounted side by side, so when one switch is closed the nose

Oil Tank Removed, Showing Contacts and Arcing Shields—By Breaking in a Horizontal Plane the Arcs Do Not Damage Other Parts.

on the armature interferes with the movement of the armature of the other contactor, thereby preventing the closing of the other switch, which would short-circuit the line.

Trade Activities

Booth Electric Furnace Establishes District Offices — Wodack Electric Tool Organized—Literature Distributed

Westinghouse, Church, Kerr & Co., Inc., New York City, has issued an illustrated folder which has for its subject "Shops." It contains a brief discussion of shops, a list of organizations for whom the company has designed and built shops, and views of several shops that it has built. The organizations for which the shops have been built include manufacturers, automobile companies, steel and iron companies, and railroads.

Trumbull Electric Manufacturing Co., Plainville, Conn., is sending out a new eight-page pamphlet on "Circle T" externally operated entrance switches and meter protective trim. It illustrates and describes in a brief and comprehensive manner two and three-pole switches with fusible top and bottom, for use either with or without meter trim. Meter trim knockouts and back plates for use with externally operated entrance switches are also illustrated and briefly described.

Harvey Hubbell, Inc., Bridgeport, Conn., is sending out a new illustrated circular on the Hubbell current tap No. 6700, showing the convenience offered to users of electrical current by this device, whether in the home, office or factory. Another circular which the company is distributing illustrates and briefly describes Hubbell multiple plugs, which increase facilities for making current connections and are a further incentive to greater use of a wider variety of devices.

Bacharach Industrial Instrument Co., Pittsburgh, Pa., manufacturer of precision instruments, is making distribution of two new pamphlets dealing with its products. Pamphlet P discusses Pitot tubes and orifices for measuring the flow of gases in connection with hydro-flow meters, and summarizes the extensive experiences of the Bacharach company in this field. Pamphlet F is devoted to Bacharach "Easy Read" pressure volume indicator for the control of air delivery to cupolas. This instrument consists of a Pitot tube installed in the blastpipe and connected to the pressure and volume indicator. The accuracy of this device is unquestioned and it is suitable for either permanent installations or testing purposes.

Wodack Electric Tool Corp., 23-27 South Jefferson street, Chicago, has recently been organized by Oscar P. Wodack to manufacture portable electric drills, grinders, hammers, etc. It succeeds the Electric Tool Repair & Maintenance Co., which has for the past 3 years been engaged in the repair and rebuilding of electric tools of all kinds. Mr. Wodack, who is president and treasurer of the new organization, recently resigned as district manager in Chicago of the James Clark Jr., Electric Co., with which he has been affiliated for 12 years. A. K. Wodack is vice-president of the company, and Albert T. Lochner, secretary and superintendent.

Delta Electric Engineering Co., Philadelphia, has undergone a change in ownership, having recently been purchased by George B. McClennen, P. J. McBride and Andrew I. Mehan, who have changed its name to the Delta Equipment Co. and will maintain headquarters at 140-142 North Third street. Mr. McClennen was for 7 years identified with the machine tool department of Frank Toomey, Inc., Philadelphia, and resigned recently, as did Mr. McBride, who in the same period was in the steam and electrical department of the same concern.

Nichols Electric Co., 123-124 North Kenton street, Dayton, O., has recently been incorporated under the laws of Ohio with a capitalization of $30,000, to conduct a wholesale electrical supply business. It now represents the following companies: J. H. Parker & Son, Bryant Electric Co., Ivanhoe-Regent Works, Detroit Insulated Wire Co., Bryan-Marsh Co., Monarch Electric & Wire Co., National Metal Molding Co., Barkelew Electric Manufacturing Co., Chicago Fuse Co., and the Square D Co. M. W. Nichols is president and treasurer of the company; G. D. Carver, vice-president, and N. J. Meyers, secretary, all of who were formerly connected with the William Hall Electric Co., Dayton.

Booth Electric Furnace Co., Chicago, whose incorporation was announced in these columns a few weeks ago, has opened up the following district offices in connection with the sale of electric furnaces for melting steel, iron, and non-ferrous metals. For New York and New England, Edward B. Stott & Co., Flatiron building, New York City, with E. F. Tweedy, secretary of the company, directly in charge; for eastern Pennsylvania, New Jersey, Maryland, Delaware and southern Atlantic Coast states, Northern Engineering Co., 308 Chestnut street, Philadelphia, with F. W. Doran in charge; for northeastern Ohio, western Pennsylvania and western New York state, Charles L. Foster, formerly sales manager of the Electric Furnace Co., Alliance, Ohio, with offices at 879 The Arcade, Cleveland, O. In connection with these district offices a complete staff of engineers and metallurgists will be maintained so that the needs of customers can be promptly met and adequately taken care of. Further announcements will be made of the opening of other district offices, arrangements for which are being completed.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is now distributing a new 4-page, 2-color folder which illustrates the distinctive features of the new swivel attachment plug recently developed by the company. This consists primarily of an inner member on which an outer member revolves, the inner member having openings for the conductor. Numerous illustrations in this folder portray the novel construction and the simple operations necessary for wiring. It is shown how the component parts of the new plug are permanently fastened together when manufactured, insuring them against becoming disassembled, separated or lost in shipment or distribution. Delay and losses due to a difference in the number of component parts in the electric appliance manufacturer's stock are thus avoided. Illustrations also show the time-saving methods of attaching to cords. Space is provided on the folder for the dealer's or jobber's imprint.

International Trade Commission Visits Westinghouse Works.—The International Trade Commission, which has been touring the United States for the purpose of studying our methods and to work out plans whereby trade conditions between their countries and ours might be improved, made a special visit to the works of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa., in course of their tour of inspection. This commission consists of prominent manufacturers, bankers and merchants as well as professional and representative business men of France, Italy, Belgium and Great Britain. Probably the most interesting member of the Commission was Monsieur Schneider who is known as the steel king of Paris. Dr. Schneider is head of the firm of Schneider & Cie of Creusot, France. This firm was largely responsible for the manufacture of the 75 mm. guns used very effectively by the Allies against the Boches. In view of the fact that this company probably supplied the American Army in France with all of its small artillery and a large part of its heavy artillery, while many American companies were shipping shells to France to be used in this gun, it seemed of special significance that Monsieur Schneider should visit our American industries. After completing the tour through the plant the party proceeded to the University of Pittsburgh where the degree of Doctor of Science was conferred upon Monsieur Schneider by the university.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Orange, Mass.—Fire which caused a loss of $100,000 at the car barns and terminal of the Orange & Athol Street Railway Co., recently destroyed a large quantity of electrical equipment. It is understood that the company is considering plans for immediate rebuilding.

Bridgeport, Conn.—United Illuminating Co., furnishing light and power service to New Haven, Bridgeport, and other nearby municipalities, has completed negotiations for the purchase of the property formerly held by the Farist Steel Corp., comprising about 8 acres of land, to be used as a site for the construction of a large new power station. It is said that the proposed plant, which will have a capacity of about 75,000 hp. for initial operations, will be one of the largest works in this section of New England.

Bridgeport, Conn.—In connection with the construction of the proposed new addition to the local plant of the Singer Sewing Machine Co. on Waterview avenue, plans have been prepared for the erection of a new pumping building at the works.

Hartford, Conn.—Hartford Electric Light Co. has had plans prepared for the construction of a new one-story brick and concrete building at its plant at 1040 Windsor avenue, to cost about $40,000. Contract for erection has been awarded to the J. H. Grozier Co., 721 Main street.

Bath, N. Y.—Bids will be received Dec. 10 for the recent issue of village bonds authorized at a special election. The issue is for $35,000 to pay for the enlargement of the municipal electric light and power plant.

Binghamton, N. Y.—Kroehler Manufacturing Co. has had plans prepared for a power house, 1-story, 34x100 ft.

Binghamton, N. Y.—George Q. Moon & Co. have awarded a contract to the Binghamton Light, Heat & Power Co. for furnishing additional electric energy for the operation of their plant. An increase of about 75 hp. is required by the company.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has completed arrangements for the furnishing of electrical energy to the Metropolitan Construction Co.

Churchville, N. Y.—Plans are under consideration by the borough officials for the installation of a new electric light and power plant for municipal service. The work will include an underground conduit system and is estimated to cost $25,000.

Endicott, N. Y.—Endicott Johnson Corp. is considering plans for the construction of a new power plant at its works.

Medina, N. Y.—Western New York Utilities Co., Inc., has filed application with the Public Service Commission for approval of a franchise granted by Clarendon officials, and permission to construct the necessary power lines for the furnishing of electric energy for light and power service. It is proposed to have this work completed by July 1.

Newport, N. Y.—Application has been filed with the Public Service Commission by the Newport Electric Light & Power Co. for permission to construct and operate a transmission system to extend from Newport to the plant of the Middletown Light Co., a distance of about 4½ miles.

New York, N. Y.—Henry L. Doherty & Co., 60 Wall street, will erect a new building on Battery place, occupying the block from Greenwich to Washington streets.

Rochester, N. Y.—Bastian Brothers Co., Clinton avenue, will erect a power house.

Rochester, N. Y.—New York State Railways Co. has arranged for the construction of a new freight terminal in the vicinity of its State street car barns, with proposed plant to include electrically operated facilities for freight handling, loading, etc.

Rochester, N. Y.—Rapid progress is being made on the installation of a new street-lighting system in the new extension of Melville road, extending beyond Culver road.

Annandale, N. J.—Plans are being arranged by prominent local interests for the formation of a new company to be known as the Annandale Light & Power Co. It is proposed to construct and operate a local electric system, electric energy to be purchased from the plant at High Bridge.

Butler, N. J.—Borough Council is completing plans for an extension of the municipal electric lighting system through Wanaque avenue, Bloomingdale district. It is understood that plans are also under consideration for an extension of the system in Larry avenue in the same section.

Newark, N. J.—Kaltenbach & Stevens, Inc., Bigelow street and Sherman avenue, has filed plans for the erection of a new boiler and plant and engine room, about 46x57 ft., at its plant. It is also planned to erect a garage building at the works the additions being estimated to cost $35,000.

Newark, N. J.—United Electric Specialty Co. has filed notice of organization to operate at 30 Clinton street to deal in electric supplies. Frederick A. Schiller, 117 Rose Terrace, heads the company.

Newark, N. J.—P. Ballantine & Sons will erect a 71x80-ft. power house. Plans provide for the installation of 4 500-hp. boilers and additional space for four similar power units.

Newark, N. J.—A factory building to cost about $45,000 will be erected by Blanchard & Co. The structure will be 2 story, 50x100 ft.

Trenton, N. J.—Plans are under consideration by the city commission for the installation of oil-burning equipment at the municipal waterworks station to replace the present apparatus at the works designed to utilize coal for fuel. It is said that the present coal situation has been a prominent factor in forwarding these plans.

Trenton, N. J.—City commission is making rapid progress on extensive alterations and improvements in the municipal electric police and fire alarm signal systems. It is understood that plans are being arranged for the installation of underground conduits to replace the present overhead wires. Electric energy for operation is furnished by the Public Service Electric Co.

Trenton, N. J.—Freeman Electric Co. has had plans prepared for the erection of a new extension, one-story, to be located on Walnut avenue.

Wildwood, N. J.—City commissioners have authorized a bond issue of $20,000, the proceeds to be used for improvements in the municipal waterworks plant, to increase the present capacity.

Allentown, Pa.—Lehigh Valley Light & Power Co. is making rapid progress on the installation of new generating equipment of increased capacity at its local power plant.

Allentown, Pa.—In connection with the expansion plant of the Steward Auto Co., 13th and Turner streets, operating a large automobile repair works, plans have been prepared for the installation of complete modern machinery, to be operated by individual motor drive. Electrically operated welding apparatus will also be installed as well as auxiliary equipment.

Catasauqua, Pa.—Borough council has approved a new ordinance providing for a new electric lighting system. The ordinance will be submitted to the Public Service Commission at once for approval.

Clearfield, Pa.—Penn Public Service Co. has inaugurated construction work on the proposed power station to be located in the vicinity of Seward, and to be used for the fur-

nishing of electric service for light and power purposes to 5 counties in the Johnstown district. The proposed works are estimated to cost $3,000,000.

Erie, Pa.—The city will appropriate $75,000 for a system for electric lighting. Address Theodore Eickhorn, superintendent.

Harrisburg, Pa.—Philadelphia Suburban Gas & Electric Co. has been ordered by the Public Service Commission to make extensions to its mains in Springfield township, Delaware county, for extensions in its service.

Macungie, Pa.—Macungie Electric Light, Heat & Power Co. is making rapid progress on the extension of its system at East Macungie, to provide for increased service.

Philadelphia, Pa.—Penn Central Light & Power Co. has recently been awarded a contract by the Borough council, Carrolltown, Cambria county, for furnishing electric service for the operation of the municipal electric street-lighting system for a period of 5 years.

Philadelphia, Pa.—General Carbonic Co. has awarded a contract to M. H. McCloskey, Jr., 1620 Thompson street, for the erection of a new one-story brick power plant, about 30x93 ft., to be located at 838-44 North 3d street. The structure is estimated to cost about $10,000. Contract has also been awarded to the same contractor by the company for the erection of a new two-story brick assembly plant and administration building, about 48 x90 ft.; and 1-story brick garage building, about 27x30 ft.

Philadelphia, Pa.—United States Government, Frankford Arsenal, Captain Hugh Lumsden in charge, has awarded a contract to M. H. McCloskey, Jr., 1620 Thompson street, for the construction of a new addition to the power plant at the Frankford Arsenal. Alterations and improvements will also be made in the existing structure, the entire work being estimated to cost $60,000.

Pittsburgh, Pa.—Plans are under consideration by the McClintic-Marshall Co. for the complete electrification of its plant at Leetsdale, definite details of which have not as yet been arranged. The company has also completed negotiations for the purchase of property aggregating about 100 acres of land in the vicinity of Leetsdale, to be used for its future expansion plans, for a consideration of about $300,000.

Seward, Pa.—Pennsylvania Public Service Co., Pittsburgh, has broken ground for a power plant to cost about $3,000,000, and which will supply current in Westmoreland, Indiana, Jefferson, Clearfield and Center counties. The first unit of the plant will be ready for operation next year.

Washington, D. C.—Fire recently damaged the conduit system in the electric substation of the Potomac Electric Power Co. at 14th and C streets. The company will commence repairs at once.

Greensboro, N. C.—Guilford Lumber Manufacturing Co. is considering plans for the installation of new engine equipment at its plant. William B. Mendenhall is secretary and treasurer.

DATES AHEAD.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Atlanta, Ga.—M. C. Kizer, a realty man, is considering ways and means for extending the white way system on Peachtree street and Ponce de Leon avenue.

Spring Creek, Ga.—Bainbridge Power Co., recently organized with a capital of $100,000, is arranging for the construction of a large new hydroelectric power plant and dam in the Spring Creek district, to cost in excess of $75,000. The plans of the company include the construction of a new transmission system and the installation of necessary machinery and equipment, to cost over $50,000. Contract for construction has been awarded to E. O'Brien, New Orleans, La. E. J. Perry, Bainbridge, Ga., is secretary and treasurer of the company.

NORTH CENTRAL STATES.

Ada, Ohio.—Ada Water & Light Co. will expend $15,000 for improving its plant. Address city clerk.

Bangor, Mich.—Benton Harbor & St. Joseph Railway & Light Co. has purchased from the village of Bangor the municipal light and power plant. The local company has obtained a 30-year franchise to furnish electricity to Bangor consumers. The plant has been in operation 18 years, but the high cost of coal, together with the need for repairs, which the village was unable to make, compelled the council to dispose of it.

Jamestown, Mich.—The village has decided to install an electric light plant. The plant will have a capacity of 500 lights, together with 4 or 5 street lamps.

Auburn, Ind.—Auburn Water & Electric Light Co. will file petition for authority to issue $40,000 in bonds for improvements.

Creagerstown, Ind.—Town Council has recently completed work on the installation of a new electric street-lighting system. Power is furnished by the Hagerstown & Frederick Railway Co., Hagerstown.

Bloomington, Ill.—Petitions are being made to light 12 blocks of city street with cluster lights. Address S. Rosenbluth, promoter.

Chicago, Ill.—Old Colony Life Insurance Co. will erect a 15-story building, 50x165 ft., to cost $1,000,000. The new building, together with the remodeled Lombard Hotel into a 15-story structure, will make an L shaped building of uniform height and design with over 170,000 sq. ft. of rentable space. The new structure will be called Jackson-Quincy-Wells building.

Chicago, Ill.—A 6-story factory building will be erected by the Chicago Addressing Co. and will involve an expenditure of about $200,000. Construction work will begin in the spring.

Chicago, Ill.—M. Born & Co., 540 South Wells street, will erect a 12-story building to cost approximately $600,000, to adjoin its present plant. The total floor space of the combined buildings will be 138,000 sq. ft.

Chicago, Ill.—Industrial Engineers have leased the entire sixth floor of the Trustees' building, 63 East Adams street, for a term of 7 years. The floor will be used as a general office by the engineering company.

Chicago, Ill.—Construction work has begun on the new plant of the Walker Vehicle Co., 531 West 39th street. The building will be 1-story and provide about 100,000 sq. ft. of floor space.

Galesburg, Ill.—Ornamental street lights will be installed on North Chambers, Willard, Bateman and East Losey streets.

Harvey, Ill.—The new welded high pressure gas line built by the Public Service Co. of Northern Illinois between the Blue Island Gas Works and Harvey was connected up to the system last month. The line will have the effect of greatly improving conditions in the district.

Rock Island, Ill.—Property owners in the vicinity of 9½ and 10th avenues on 31st street have petitioned the council to place electric lights. Address Commissioner Frank Wich, department of streets and public improvements.

Springfield, Ill.—A new lighting system for Williams place will be installed at a cost of $3812. Address City Engineer Wade Seeley.

Urbana, Ill.—Board of local improvements has ordered the installation of an ornamental lighting system on West Elm street, to cost $3160.

Antigo, Wis.—Antigo Tractor Co., recently organized, will erect a machine shop and assembling plant to cost $150,000.

Ashland, Wis.—Ashland Light & Power Co. contemplates a lighting plant at Junction.

Monroe, Wis.—Monroe Electric Co. will build an addition to its power plant. L. A. Turner, general manager.

Duluth, Minn.—Minnesota Steel Co. plans to spend about $5,000,000 for the erection of additional units to its plant. The projects include the conversion of a rail mill into a continuous billet mill, the construction of a rod mill, a wire nail mill, and a new residence section at Morgan Park to

house employes. The housing project is estimated to cost $2,000,000 alone.

Faribault, Minn.—Northern States Power Co. (Faribault division) has received an order for an additional 150 hp. in motors to be installed in the addition being made to the Zumbrota Clay Manufacturing Co.'s plant.

Minneapolis, Minn. — During the week ended Nov. 14 the sales department of the Minneapolis General Electric Co. (Northern States Power Co.) secured 328 new electric light and power customers with 192 kw. of lighting and 256 hp. in motors. The sale of electric household appliances continues very good. New business connected to the company's lines shows a gain of 223 customers with 224 kw. of lighting and 20 hp. in motors. Output of electric energy was 37.8% greater than during the corresponding week last year.

St. Paul, Minn.—Northern States Power Co. has accepted a contract covering the electric requirements of a new bakery being established by the Zinsmaster Baking Co.

Buck Grove, Ia.—City has signed contract between Denison and Buck Grove for electric current to be furnished from Denison by December.

Clinton, Ia.—Clinton Street Railway Co. contemplates constructing a line to South Clinton. A. L. Schuyler, attorney for county.

Dubuque, Ia.—Eastern Iowa Electric Co. of Dubuque contemplates extension of transmission lines from Peosta to points in Vernon, Prairie Creek, Whitewater and New Wine townships.

Massena, Ia.—City contemplates the construction of municipal electric light plant. C. W. Stoker, village clerk.

Minerva, Ia.—Minerva Electric Co. will construct transmission lines along public highways in Marietta township. W. F. Goecke, president.

West Liberty, Ia.—Town will hold an election to vote $38,000 bond issue for a municipal electric light plant. Irwin Atkins, town clerk.

Bertrand, Mo.—Electric power and current will be furnished within a short time by the Missouri Public Utilities Co. from Charleston.

Abilene, Kan.—Election will be held Dec. 13 to vote $450,000 in bonds for the purpose of building a pipeline connection to Lake Abilene.

Canton, Kan.—Election will be held Dec. 8 to vote $37,000 in bonds for erecting and equipping a waterworks plant and $18,000 in bonds for erecting buildings or additions thereto and purchase of machinery, equipment and for the purchase of pole lines for producing and transmitting electric current.

Geneseo, Kan.—Bonds will be voted in the near future for the erection of an electric power plant or to build a transmission line from the United Water, Gas & Electric Co. at Hutchinson. Estimates on the latter have been furnished and bonds to the amount of $25,000 will probably be voted.

Girard, Kan.—The city commissioners passed an ordinance authorizing the issuance of $40,300 in water and light bonds to cover the cost of purchasing and installing new oil engines and other equipment at the light plant. Two 200-hp. Fairbanks-Morse oil engines will be installed with built-in generators.

Hugoton, Kan.—Election to vote bonds for the installation of a city water and light plant carried. The bonds have been sold, but the contract has not been let for the plant. The site is not yet selected.

Hutchinson, Kan.—Plans are being made for the enlargement of the plant of the United Water, Gas & Electric Co. at Hutchinson, because of the increased demand from surrounding towns.

Lenexa, Kan.—The proposition of building a power plant is being discussed. The plant will be built in the near future unless it is found advisable to connect with the high power line to Olathe by the Kansas City Light & Power Co. which is under construction.

Little River, Kan.—Election to vote $30,000 in bonds for the improvement of the electric light system, carried. A high-tension transmission line is to be constructed to connect with wires of the United Water, Gas & Electric Co. at Lyons.

Lyndon, Kan.—A special bond election is contemplated in the near future to vote bonds for improving the electric system.

Olathe, Kan.—Olathe Electric Light & Power Co. has perfected arrangements by which it is to receive high-voltage current from Kansas City. A new substation will be erected for its reception.

Palmer, Kan.—Election will be held Dec. 22 to vote $21,000 for a new waterworks system, work including complete new plant pipe lines and stand pipe. W. B. Rollins, 209 Railway Exchange building, Kansas City, Mo., engineer. E. H. Hornbustel, city clerk.

Solomon, Kan.—A special election is to be called in the near future to vote $75,000 in bonds to install a system of waterworks.

Spivey, Kan.—A $10,000 bond election for the purchase of 1 30-hp. oil engine and storage battery, carried. Mattie Friend, city clerk.

St. Francis, Kan.—Election to vote $55,000 in bonds for the erection of a new electric light plant building and equipment for same, carried.

Mitchell, S. D.—Dakota Central Telephone Co. will build additions and install 200 telephones. B. J. Savis, engineer.

SOUTH CENTRAL STATES.

Hazard, Ky.—Kentucky & West Virginia Power Co. has had plans prepared for extensive improvements and extensions at its plant, including the installation of new equipment. It is proposed to install 2 new 833-hp. boilers, equipped with underfeed stokers; 3000-kw. turbine, with surface condenser, and auxiliary apparatus. The plans of the company also include extensions to the boiler plant.

Louisville, Ky.—The commercial department of the Louisville Gas & Electric Co. during the week ended Nov. 18 secured 96 new electric light and power customers with 41 kw. of lighting and 77 hp. in motors, and accepted contracts for wiring 39 already built houses. New business connected by the company shows an increase of 74 customers with 38 kw. of lighting and 27 hp. in motors. Electric energy output was 23.1% greater than during the corresponding week last year.

Pikeville, Ky.—Kentucky & West Virginia Power Co. is having plans prepared for the installation of a new electric substation on the Big Sandy river, of 10,000-kv-a., step-down type; and extensions in its 88,000-volt transmission line and 44,000-volt distributing system for increased service for local and nearby coal mining operations.

Monroe, La.—Election to vote $450,000 in bonds for an electric light plant, carried. Bonds will be sold about Jan. 20. P. A. Poag, city clerk.

Claremore, Okla. — Representatives of the Charles Page interests are contemplating erecting a high-tension transmission line from Sand Springs to Claremore for commercial purposes.

Enid, Okla.—The local distribution system at Bison will be completed within a week or two, with the exception of the substation. Work on the Garber-Covington transmission line will be started soon, most of the material having already been received.

Grandfield, Okla.—City has approved the issuance of bonds for $75,000, the proceeds to be used for improvements and extensions in the municipal electric light and waterworks systems.

Minco, Okla.—Bonds to the extent of $11,000 which were recently voted have been approved and the money will be expended immediately for the improvement of the light and water system. New machinery is to be installed at the light plant and extensions made on the water mains.

Oklahoma City, Okla.—New business secured by the Oklahoma Gas & Electric Co. includes contracts covering an initial installation of 400 hp. in motors for operating casinghead gasoline plants near Beggs, Okla.

Perry, Okla.—City council has completed arrangements for improvements in the municipal electric-light and water systems. The plans include the installation of 2 new oil-engine generating units, switchboard, and auxiliary apparatus. Black & Veatch, Kansas City, Mo., are engineers.

Sulphur, Okla.—Plans are being made for a white way on the main street.

Thomas, Okla.—City contemplates the installation of 90-hp. Diesel engine to improve electric light to furnish power for 18-hour service. Address mayor.

Wilson, Okla.—Plans are in progress for the installation of 2 200-hp. boilers, also a 200-hp. engine. J.

W. Ryder, 614 C street, N. W. Ardmore, Okla., engineer.

Fort Worth, Tex.—Fire originating in the boiler plant of the Farmers' Gin Co., Roanoke, near Fort Worth, recently damaged the plant to the extent of $25,000.

Marlin, Tex.—Work on the new electric light and power plant will begin not later than Jan. 1, 1920. Contracts for material have been let.

Normangee, Tex.—W. L. Martin has purchased the electric light plant together with the water works plant from H. E. Shaw, at a consideration of $10,000.

Olden, Tex.—A telephone exchange building and an electric street lighting system are under consideration. Address mayor.

WESTERN STATES.

Sandpoint, Ida.—The city has renewed for two years its street lighting contract with the Mountain States Power Co.

Cordova, Alaska.—Alaska Public Utilities Co., which produces electricity by water power and a Diesel engine, has a new generator on the ground for the driving of which additional Diesel engines will be provided.

Centralia, Wash.—Surveying the ground and laying out the site preparatory to the erection of the steam plant of the Sherman County Light & Power Co. is under way, same to cost about $150,000. Machinery which was formerly intended for a steam plant at Lewiston, Ida., is on hand.

Everett, Wash.—Eclipse lumber mill, now operating under steam power, is to be completely equipped for electric drive. A new building is to be erected to house machinery for finishing operations, electrical equipment for which will be installed.

Molson, Wash.—This city is considering the matter of establishing its own utilities, particularly light and water.

Seattle, Wash.—Contract for furnishing 3 5000-kv-a. transformers at $222.50, for use at Cedar Falls extensions of the city light plant, has been awarded to Allis-Chalmers Manufacturing Co.

Seattle, Wash.—Saxe & Hussey have opened an electrical appliance store, and contemplate serving the local trade and engaging in export business with oriental countries.

Seattle, Wash.—J. D. Ross, superintendent of the lighting department, has requested that $500,000 of utility bonds be sold as soon as possible to provide funds for financing extension of the light plant imperatively needed, while waiting, pending decision of the supreme court as to validity of a $1,755,000 bond issue.

Seattle, Wash.—NePage McKenney & Co., electrical engineers, contractors and manufacturers, are installing electrical equipment for lights and power in the Mallory apartments, at 47th street and 14th avenue, North East, and installing electrical equipment in the new store building of John Graham at Second avenue and Pine street. They have completed installation of the electrical equipment at the schools in Bremerton and Charleston, Wash., and in the Togo Hotel at Bremerton. They are installing electrical equipment in the infirmary building and in an addition to the female ward Northern State Hospital at Sedro Woolley, Washington, and have practically completed work in the new high school at Hamilton, Wash. They are now installing stage lighting, border lights, foot lights, strip lights, announcement letters and dimmers in the Liberty theater at Wenatchee, Wash.

Vancouver, Wash.—Petitions have been circulated in the business district asking that cluster lights be installed on both Main and Washington streets.

Roseburg, Ore.—The proposal to issue bonds in the sum of $500,000 for constructing a municipal light and water plant will probably be decided at the coming special election.

Eureka, Cal.—An order has just been placed by an electrical dealer in Ferndale for 69 single-phase motors to be used for operating milking machines to be served with power by extensions now being made by Western States Gas & Electric Co.

Los Angeles, Cal.—San Joaquin Light & Power Co. is now erecting a 40,000-hp. plant. A still larger plant is now being contemplated which will generate 300,000 hp. It will be located on the north fork of the Kings river canyon and will be one of the largest power plants in the country. Construction on this plant will not start for a number of years. The first steps toward the erecting of the power house will be the building of a first-class road along the banks of the Kings river to the site. This it is understood will entail an expenditure of $250,000. W. G. Kerchoff, president.

Salinas, Cal.—Mayor George A. Daugherty has appointed a committee to co-operate with the city council in investigating the taking over of local gas, water and electrical service system, now owned and operated by the Coast Valleys Gas & Electric Co., or installing new plants in case the Coast Valley's interest cannot be acquired at a satisfactory figure. A public utility expert from Los Angeles has been engaged to make an inventory of the Coast Valleys' properties as a basis for negotiations.

CANADA.

Almonte, Ont.—The council plans to remodel its power plant and to purchase a new generator. Chairman of Commission, Mayor McDowall.

Jarvis, Ont.—Estimates will be secured at once on the cost of installing a hydroelectric street lighting and power distribution system. Clerk C. S. McCarter.

Toronto, Ont.—Canadian Allis-Chalmers, Ltd., is erecting a new 1-story plant, 65x150 ft. for the purpose of electrogalvanizing and enameling electric conduit. Electric monorail cranes will operate over the pickling and plating tanks. Three plating dynamos, each of 5000 amperes and other modern equipment will be installed. In addition to equipment used in zinc plating, baking furnaces and appliances for black enameling of conduit in all sizes will be installed. About 12,000,000 ft. of conduit per year will be produced.

PROPOSALS

Wireless Station.—Bids will be received until June 30, 1920, by Ministerio de Fomento de los Estadoa Unidos de Venezuela for the construction and installation of a new wireless station and system to be located in the vicinity of Caracas.

Electric Light Plant.—Bids will be received until March 15, 1920, by the Port Commission, Port Commission Offices, Santiago, Chile, for the installation of an electric lighting and motive power plant for the furnishing of service for the port of Valparaiso.

Electrical Equipment.—Until Dec. 10, bids will be received by the Secretary of the Board of Commissioners, 509 District building, Washington, D. C., for electrical equipment, including switchboard installation at the Central High School, as well as machine shop equipment.

Electric Work.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Dec. 23, for furnishing materials for the construction of an extension to the Animal House for the Hygienic Laboratory, United States Public Health Service, Washington, D. C., including materials for concrete, reinforced concrete, stone, brick, miscellaneous iron and steel work, composition roofing, sheet metal work, lumber, millwork, electric work, hardware, etc., in accordance with drawings, specifications and bills of quantities attached thereto, copies of which may be obtained at this office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Engineering Materials (31,312).—A civil and mechanical engineering firm in India desires to represent manufacturers and exporters for the introduction into India of American machinery, and engineering and structural materials. Quotations should be given c. i. f. ports of India. References.

Electrical Apparatus (31,345).—A manufacturer in Spain desires to secure an agency for the sale of motors and dynamos, electric heating apparatus, electrical conductors, electric lamps of ½ and 1-watt (tools) insulated and enameled copper wire on bobbins and resistance wires. Correspondence should be in Spanish. References.

Personals

J. W. Carpenter Appointed Vice-President of Texas Power —H. B. Joyce Joins United Electric Light & Power Co.

A. P. HARRIS, manager of the Hickman plant of the Kentucky Light & Power Co., Fulton, Ky., has resigned to enter the service of the Edwardsville (Ill.) Water Co.

THOMAS E. DEMPSEY has resigned as chairman of the Illinois Public Utilities Commission and is succeeded by James H. Wilkerson, a member of the commission and formerly United States district attorney in Chicago.

E. H. SNIFFEN, manager of the power department of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., recently tendered an interesting address on "The Steam Turbine" at a meeting of the Duquesne Light Co. Section of the National Electric Light Association in the auditorium of the Chamber of Commerce building.

J. C. GRINDELL, formerly with the Wagner Electric Co., is now district manager for St. Louis Electrical Works at 1427 L. C. Smith building, Seattle, having charge of sales in Washington, Oregon and in the Orient. He recently sold between 40 and 50 motors to the Aladdin Co., which is establishing a factory in Portland, Ore.

CARROLL G. BROWN, for 4 years professor of electrical engineering at Cornell University and more recently connected with the testing department of the General Electric Co., has accepted a position on the faculty of the School of Engineering of Milwaukee. He was also connected with the American Telephone & Telegraph Co. and conducted the research department of the Rochester Railway & Light Co.

J. W. CARPENTER, manager of the Dallas Power & Light Co., Dallas, Tex., has been appointed vice-president and general manager of the Texas Power & Light Co., succeeding Fred R. Slater, resigned. Mr. Carpenter began work in the electrical field as a day laborer and by his efforts and industry steadily advanced to high executive positions. After taking a course in electrical engineering, Mr. Carpenter was employed in some of the large electrical machinery factories. He was for some time connected with the Northern Ohio Traction Co. as construction engineer, resigning this position to take over the management of the Corsicana Gas & Electrical Co., Corsicana, Tex. He later became president of the company and at the same time was president and general manager of the Athens Electric Light & Power Co. and other smaller companies. He resigned these connections about two years ago to accept the position of manager of the Dallas company, from which he has just been promoted. Mr. Carpenter has been identified with the electric utility business for the last 18 years and is well known in business, social and civic affairs of Dallas. He is president of the Dallas Jovian League and is a member of various other organizations.

W. D. BAKER, assistant division superintendent of Division "K" of the Public Service Co. of Northern Illinois, has resigned and is succeeded by E. S. Looker.

R. W. SUTHERLAND, secretary of the Splitdorf Electrical Co., Newark, N. J., has been elected general manager of the company to succeed C. W. Curtiss, recently resigned. Mr. Sutherland will also continue in the capacity of secretary.

JAMES H. WILKERSON, former United States District Attorney, has been appointed chairman of the Illinois Public Utilities Commission by Governor Frank O. Lowden to succeed Thomas E. Dempsev, of East St. Louis, Ill., who has resigned. Mr. Wilkerson has been a member of the commission for a number of months, succeeding Fred E. Sterling, who was elected state treasurer of Illinois at the last election. Mr. Wilkerson has been a prominent attorney in Chicago and has served as United States district attorney in that city.

RALPH NEUMULLER, formerly assistant advertising manager of the New York Edison Co. and general manager of the Electric Publications Syndicate, has been appointed advertising manager of the United Electric Light & Power Co., New York. During the war, Mr. Neumuller was a member of the 326th Infantry, 82nd Division, which saw considerable action in France. The division had the distinction of remaining in continuous offensive action for a longer period without relief, during the Meuse-Argonne operations, than any other unit in the American Expeditionary Forces. Following the armistice, Mr. Neumuller was assigned to G-5 (Athletics), Paris, where he was placed in charge of Ceremonies and Parades during the Inter-Allied games at the Pershing Stadium.

MATHEW RUTHERFORD BIDDELL has been appointed assistant professor of aeronautic engineering and assistant director of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., effective Jan. 1. He will be a member of the staff of the mechanical engineering faculty. His specialty in experimental work will be in studies of aeroplane crankshafts and other parts of planes which have been subject to breaks and defects. Professor Biddell has been until recently chief engineer for the Canadian Aeroplanes, Ltd., of Canada, and had previously served that company as chief draftsman and later as testing engineer. In the latter position he tested all materials which entered into the construction of planes built by the company. From June, 1915, to Dec., 1916, he was chief draftsman for the Curtiss Aeroplane & Motors Co., Ltd., of Canada. He was graduated from the School of Applied Science and Engineering of the University of Toronto in 1906 with the degree of Bachelor of Applied Science. He received both preliminary and final honors.

MAJ. H. B. JOYCE, recently discharged from military service, has been appointed manager of the power bureau of the United Electric Light & Power Co., New York. Commissioned a captain in the Quartermaster Corps, and assigned to Chief Construction Division on Aug. 13, 1918, he was immediately placed in charge of the operation of all refrigerating equipment under the jurisdiction of that division handled by the maintenance and repair branch. In November, 1918, Mr. Joyce was placed in charge of the section of the maintenance and repair branch handling the operation and maintenance of all electric generation, distribution and its utilization; heating equipment and its operation and maintenance, and refrigerating equipment together with its operation and maintenance which were under the jurisdiction of the Construction Division. These utilities were in some 370 odd separate and distinct locations scattered throughout the United States and dependencies. The approval of technical terms and conditions in all service contracts for the supply of electricity, heat, gas, refrigeration, etc., were also handled in this section. Promoted to Major on May 28, 1919, he continued in the same work. On July 1, 1919, Mr. Joyce was placed in charge of the operating section of the Engineering Division. He handled all engineering necessary for the operation and maintenance of utilities including that necessary in connection with the repairs to buildings, roads, water and sewer systems, purification plants, etc., under the jurisdiction of the Construction Division, in all camps, cantonments, base hospitals, storage depots, port terminals and regular army posts throughout the United States and its dependencies.

Obituary.

JAMES B. MCCARTHY, of Detroit, Mich., who for many years has been special representative of the National Metal Molding Co., was killed on his farm near Detroit last week. At the time of going to press no details are available regarding the circumstances. Mr. McCarthy was publisher of *Electrocraft*, which paper was absorbed by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in December, 1911. He was connected with the Electrical Review Publishing Co. for several years after this as assistant general manager. Later he joined the National Metal Molding So. and during his connection with that firm assigned to it many valuable patents on brackets and other construction devices.

Financial News

Montana Power Pays Dividend.

Montana Power Co. declared regular quarterly dividend of ¾% on the common stock and 1¾% on the preferred. Both dividends payable Jan. 2 to stock of record Dec. 13. Action of the directors of Montana Power Co. in declaring a 75-cent dividend on the common stock, the same as last quarter, definitely disposes of the unfounded rumors that the company would omit the disbursement of the junior issue this quarter. Referring to this matter, following the meeting of the board, an official of the company stated that these rumors had no foundation, as directors had never contemplated passing the common stock dividend.

While earnings statement for the third quarter of this year did not show up as well as 1918, this has been due primarily to extremely poor business conditions throughout Montana, brought about by a severe drought. Conditions the first part of the final quarter have shown improvement which is expected to be reflected in earnings.

The Montana Power Co. for the 9 months to Sept. 30 showed earnings available for dividends on the preferred and common stocks of $1,901,031. Deducting preferred dividends for this period amounting to $509,250, left a balance of $1,391,781 available for common stock dividends or $3.20 a share. This is at an annual rate of $4.25 a share compared with $5 87 a share actually earned for the fiscal year 1918.

Emerson Electric Stock Offered.

Caldwell & Co., St. Louis, are offering $1,000,000 7% cumulative preferred stock of the Emerson Electric Manufacturing Co., at 97½ and accrued dividend to yield about 7.18%. The proceeds of this issue will be used for the construction of a new factory building immediately adjoining its plant and provide additional working capital. The demand for the company's products is increasing rapidly, and the company is unable to handle all business offered it with present facilities. Upon completion of the new factory building, the sound valuation of plant and equipment will be equal to approximately 143% of the present issue of $1,000,000 preferred stock. In addition, net quick assets on Sept. 30, 1919, after giving effect to present financing were equal to over 130% of the par value of the preferred stock, thus giving the company net tangible assets equal to over 273% of the preferred stock.

The net earnings of the company after taxes, depreciation, etc., available for dividends in the four years ended Sept. 30, 1919, averaged $247,887.80 per year, equivalent to over three and one-half times the annual dividend requirements on the $1,000,000 7% cumulative preferred stock. Net earnings after taxes, depreciation, etc., for the year ended Sept. 30, 1919, were $281,498.37, equivalent to over four times the annual dividend requirements on preferred stock.

Niagara & Erie Power Bonds Authorized.

Public Service Commission has granted permission to the Buffalo & Lake Erie Traction Co. and its receiver to sell, assign and transfer to the Niagara & Erie Power Co., Buffalo, certain of the special franchises granted the company by the municipalities of Dunkirk, Silver Creek, Angola, and Brocton under which the company's transmission system between Athol Springs and West Portland exists. The Niagara & Erie Power Co. at the same time is authorized to issue bonds for $225,000 and common stock for $44,500, the proceeds to be used for the purchase of this transmission line. The commission has also authorized the Niagara, Lockport & Ontario Power Co. to issue bonds for $101,000 and first preferred stock for $28,600, the proceeds to be used for the purchase of 480 shares of the common stock of the Niagara & Erie Power Co. held by the receiver of the Buffalo & Lake Erie Traction Co.

Kansas City Capital Increase.

The Kansas City Light & Power Co. has filed a statement with the secretary of state increasing its capital stock to $20,000,000. This sum the company was authorized to issue by the state public service commission some time ago. The incorporation fee paid by the company to the secretary of state was $10,001.25.

The commission has also authorized the company to issue $717,000 of new securities. It is said that the company will apply to the commission for additional authority to increase the issue of its securities.

Gas & Electric Securities to Declare Monthly Dividends.

Gas & Electric Securities Co., which financed the organization of the Cities Service Co., has declared a dividend of 3%, payable Dec. 1 in common stock at par to common stockholders of record Nov. 15. Announcement is also made that the company intends to declare monthly dividends in common stock at par at the rate of ½ of 1% on the first day of each month in 1920 to stock of record the 15th of the preceding month, these dividends being in addition to the regular cash dividends of ½ of 1% being paid monthly at present.

It is understood that the board of directors of Gas & Electric Securities Co. has adopted a dividend policy for the common stock of regular dividends, payable in common stock at par, in addition to the regular monthly cash dividends, this policy providing for the payment of the 3% dividend on Dec. 1, with 6% in stock dividends in 1920, payable monthly at the rate of ½ of 1% a month, with an increase in this stock dividend each year thereafter of 3% so long as earnings of the company are sufficient to justify the payment of such stock dividends. A similar policy is now being carried out respecting the common stock of Cities Service Co.

Commonwealth Power Earnings Compare Favorably.

During the last three months of 1918 earnings of Commonwealth Power, Railway & Light Co. and subsidiaries were adversely affected by the influenza epidemic. The statement for October, 1918, showed a deficit of $48,082 after fixed charges, which compares with a surplus of $218,878 earned during October, 1919.

Surplus after charges for 12 months ended Oct. 31, 1919, amounts to $2,185,058, equal to $12.23 on $17,953,000 of 6% cumulative preferred stock. Preferred dividends in cash were discontinued with the last payment in 1917. Since then regular quarterly dividends have been paid in 6% interest-bearing scrip maturing six years from date of issuance. After allowing for deduction of 6% on the preferred, the latest 12 months' earnings show $5.96 earned on $18,585,900 of common stock.

Earnings of Commonwealth Power, Railway & Light Co., and subsidiaries, for October, 10 and 12 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$2,289,807	$1,799,628
Net earnings	913,113	600,587
Surplus after charges	218,878	*48,082
Balance, after preferred dividend	129,113	*137,847
10 months' gross	20,929,618	17,715,992
Net earnings	8,586,629	6,720,818
Surplus after charges	1,777,246	543,091
Balance, after preferred dividend	879,596	*354,558
12 months' gross	25,131,687	21,534,193
Net earnings	10,365,843	8,300,450
Surplus after charges	2,185,058	916,994
Balance, after preferred dividend	1,107,878	*160,185

*Deficit.

Surplus after charges, as shown is available for dividends, replacements and depreciation. Fixed charges include dividends on outstanding preferred stock of constituent companies in addition to taxes and interest.

American Capital to Finance Italian Electric Trust.

The long protracted negotiations under the minister of transport have resulted in the formation of a joint Italo-American combine, with a capital of 800,000,000 lire (at normal rates, $150,000,000) for electrification of the state railways of Italy and for the utilization of water power in the Trentino and other parts of Italy. All of the plant will be supplied by America.

Marconi Deal Ratified.

At a special meeting the stockholders of Marconi Co. of America voted in favor of the absorption of the company by the Radio Corp. of America. The General Electric Co., which is backing the Radio corporation, is to contribute $2,500,000, part of which will be used to acquire American Marconi shares held by the British Marconi Co.

The new company is to have a capital of 5,000,000 shares of 7% preferred stock, $5 par, and 5,000,000 shares of common stock of no par value, of which the General Electric Co. will receive 135,174 shares of preferred stock and 2,000,000 common. American Marconi stockholders are to have the privilege of exchanging their holdings, par for par, for Radio preferred and in addition to receive Radio common shares equal to number of Marconi shares held.

Detroit Edison Increases Stock.

At a special meeting of Detroit Edison Co. held last Monday, stockholders approved an increase in the authorized capital stock from $35,000,000 to $60,000,000, and authorized the issue of an additional $10,000,000 face value of debentures. The board of directors was also authorized to issue and dispose of the additional stock and bonds, at such time and in such manner as they by resolution prescribe and to confer conversion privileges on the holders of the debts or obligations evidenced by the debentures.

During October, the maximum load on the company's plants ranged between 15 and 20% above the maximum of the war period, and the 24-hour output of current was largely in excess of the wartime figures, notwithstanding the cessation of night shifts and of Sunday work which were required last year by the war necessities of the Government.

Hurley Machine Sales Show Big Gain.

At a special meeting of the board of directors of the Hurley Machine Co. an initial quarterly dividend of $1 a share on the new no par value common stock was declared, payable Jan. 5, to stockholders of record as at Dec. 10.

The rate indicates a considerable increase of that paid on the old common. The quarterly dividend paid Oct. 1 was at the rate of 8% per annum on the old shares, which were of a par value of $100, and which has now been exchanged for the new shares on the basis of seven new shares for one of old. The dividend declared therefore is equivalent to an annual rate of 28% on the old stock.

The report made to the board showed the net sales of the company for the 11 months ended Nov. 28, 1919, to be $5,072,281, as compared with the first 11 months of 1918 of $2,553,577, or an increase of $2,518,709. The sales for the 3 months ended Nov. 28, 1919, were $1,884,974, as compared with the same 3 months of 1918, which were $978,884. This increase, it is stated, is not due to higher selling prices, but to enlarged quantities.

Dividends.

General Electric Co. has declared a dividend of $2 per share, payable in cash on Jan. 15, 1920, to stockholders of record Dec. 6; also a dividend of 2% has been declared, payable in stock of the company at par on Jan. 15, 1920, to stockholders of record Dec. 6. Stockholders will be paid the cash value of fractional shares aris-

For the Readjustment Period—What?

LX.

BRAVO DUNEDIN!

Under this heading the "Electrical Review" of London prints an item as follows:

"We are indebted to a New Zealand correspondent for a copy of a local newspaper dated July 30th, reporting the proceedings at the Dunedin City Council when it was resolved to give preference to a British tender for electrical plant over an American tender which was £800 less. The Council, says the report, decided to accept the tender of the British Westinghouse Co. for a synchronous motor for Half-Way Bush, although the American General Electric Co.'s tender was £3,258, as against the British firm's £4,070, and the latter required a longer term for delivery.

"Councillor Shacklock, in introducing the matter, said that at the last meeting of the Council the matter of accepting a tender for the motor had been held over for further information by cablegram. This had been received and the engineer recommended that the tender of the British Westinghouse Co. be accepted. The purpose of recommending this tender was to obtain a motor of English manufacture. An American machine could be obtained for £800 less and delivery got in five months, whereas the British machine could not be delivered for nine months. The delay might involve some restriction on the users of electric power. He would move that the tender of the British Westinghouse Co. be accepted, provided delivery be given in nine months.

"Councillor Sincock asked would the Westinghouse machine be a more durable machine and what loss was involved to the small users (at present restricted) in the fact that the machine would not get here for nine months. Unless there was some defect in the American machine, he felt inclined to adhere to their original idea of getting the American machine, which could be secured quicker.

"Councillor Clark said he was surprised to hear Councillor Sincock. He hoped the Council would not go beyond the Empire because a little inconvenience or money was involved.

"Councillor Shacklock, in reply, said the British Westinghouse machine was quite satisfactory. The department would do its best to meet the demands of the consumers without restrictions, and if such were necessary it would be only in the depth of winter. The tender was accepted."

This item of news reflects very clearly the prevailing tendency of Great Britain, her dominions and her colonies to do their trading within the Empire itself. American manufacturers can most profitably concentrate on other countries—particularly non-European—for export business. For the present, however, domestic trade should be our chief, although by no means our only, concern.

C. A. TUPPER, Chicago.
President International Trade Press, Inc.

ing out of such stock dividend, based upon the market price of the stock on Dec. 6, except as to those who request script certificates for fractions.

The Chicago Telephone Co. has declared a quarterly dividend of 2%, payable Dec. 31, to stockholders of record Dec. 30.

The Montana Power Co. has declared a dividend of ¾ of 1% on common stock and a quarterly dividend of 1¾%, both payable Jan. 2, 1920, to stockholders of record of Dec. 13, 1919.

Earnings.

ADIRONDACK ELECTRIC POWER.

	1919.	1918.
October gross	$ 161,982	$ 161,932
Net after taxes	71,481	47,290
Surplus after charges	44,813	26,025
12 months' gross	1,741,846	1,794,744
Net after taxes	622,513	322,946
Surplus after charges	331,389	66,770

VIRGINIA RAILWAY & POWER CO.

Earnings for October and four months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$ 811,308	$ 594,947
Net after taxes	294,612	128,278
Surplus after charges	119,032	*30,421
4 months' gross	3,104,506	2,666,613
Net after taxes	1,213,842	857,203
Surplus after charges	535,547	211,348

*Deficit.

ALABAMA TRACTION, LIGHT & POWER CO.

Earnings of Alabama Power Co., operating subsidiary of Alabama Traction, Light & Power Co., Ltd., compare as follows for October and 12 months ended Oct. 31:

	1919.	1918.
October gross	$ 275,142	$ 275,827
Net after taxes	129,806	114,931
12 months' gross	3,099,126	2,828,804
Net after taxes	1,725,930	1,521,132

PHILADELPHIA RAPID TRANSIT.

Earnings of Philadelphia Rapid Transit Co. for October and 10 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$3,165,552	$2,411,985
Net after taxes	1,025,141	617,267
Surplus after charges	256,806	*138,925
10 months gross	29,160,983	25,535,542
Net after taxes	9,131,942	8,651,775
Surplus after charges	1,463,758	1,154,797

*Deficit.

DETROIT UNITED RAILWAY.

	1919.	1918.
September gross	$2,320,351	$1,710,423
Net earnings	470,279	350,838
Surplus after charges and taxes	280,383	144,275
9 months' gross	17,862,320	14,103,983
Net earnings	3,712,837	3,256,220
Surplus after charges and taxes	1,919,633	1,520,416

AMERICAN WATER WORKS & ELECTRIC CO.

American Water Works & Electric Co., Inc., reports earnings for the year ended June 30, as follows:

	1919.	1918.
Water Works earn.	$ 5,011,316	$ 4,973,352
West Penn. Rys.	10,362,483	8,601,358
Total gross earn.	$15,373,799	$13,574,750
Net earnings	1,263,953	1,396,258
Surplus after charges	435,110	585,185

GREAT WESTERN POWER.

Earnings of the Great Western Power System for October and 12 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$ 420,450	$ 401,070
Net after taxes	245,339	240,651
Surplus after charges	55,658	69,093
12 months' gross	5,224,303	4,515,249
Net after taxes	3,055,230	2,588,380
Surplus after charges	929,350	762,592

MASSACHUSETTS LIGHTING COMPANIES.

The gas and electric light companies owned by the Massachusetts Lighting Companies report aggregate sales of gas and electricity, excluding inter-company items, as follows:

	1919.	1918.
October net	$ 161,666	$ 138,849
4 months' net	621,389	557,823

COLUMBIA GAS & ELECTRIC CO.

Consolidated earnings statement of Columbia Gas & Electric Co. and subsidiaries, compares as follows.

	1919.	1918.
October gross	$ 939,757	$ 856,709
Net after taxes	426,686	386,530
Surplus after charges	192,034	197,085
10 months' gross	9,525,602	9,353,690
Net after taxes	4,641,886	4,647,649
Surplus after charges	2,427,708	2,715,252

Paducah Electric Bonds Offered.

An offering of first mortgage 6% five-year gold bonds of the Paducah Electric Co. is being made by Powell, Garard & Co., Chicago. They are selling at 95.75 and interest and yield over 7%. The properties owned and controlled by the company include an electric station, with a rated capacity of 2440 hp.; gas works, with a daily generating capacity of 490,000 cu. ft.; electric and gas distributing systems, reaching all of the desirable portions of the city; steam heating mains, serving the central business district; 17 miles of standard gauge street railways, and 75 acres of valuable real estate and miscellaneous buildings. The present depreciated value of properties, exclusive of any allowance for franchises and going value, is conservatively estimated at $1,315,202, or 117% in excess of first mortgage bonds now outstanding.

The consolidated statement of operation of the company and its subsidiary and predecessor companies for years ended Sept. 30, 1917, to 1919, is as follows:

	1917.	1918.	1919.
Gross earnings	$304,588.70	$313,570.38	$390,642.92
Operating expenses, including taxes and maintenance charges	228,803.44	231,114.38	278,655.80
Net earnings	$ 75,785.36	$ 82,456.00	$111,987.12
Annual interest requirement on $236,400 5% and $368,100 6% first mortgage (this issue) bonds			33,906.00
Balance			$ 78,081.12

CITIES SERVICE CO.

	12 mos. ending Oct. 31, 1919.	12 mos. ending Oct. 31, 1918.	Oct., 1919. Month of	Oct., 1918. Month of
Gross earnings	$20,234,196.07	$22,097,814.00	$1,498,677.15	$1,784,000.30
Expenses	692,101.57	476,727.02	57,782.33	57,012.65
Net earnings	$19,542,094.50	$21,621,087.88	$1,440,894.82	$1,726,987.65
Interest on debentures	1,714,934.39	160,761.48	159,206.02	60,344.78
Net to stock	$17,827,160.11	$21,460,326.40	$1,281,688.80	$1,666,642.87
Dividends, pfd. stock	4,158,225.00	4,019,574.00	357,895.50	337,024.50
Net to common stock and reserves	$13,668,935.11	$17,440,752.40	$ 923,793.30	$1,329,618.37
Debenture fund				$ 906,895.12
Contingent fund				568,274.14
Stock surplus				1,607,720.74
Surplus reserve				6,980,534.64
Surplus				32,263,171.41
Total surplus and reserve				$42,326,596.05

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Nov. 25.	Bid Dec. 2.
Adirondack Electric Power of Glens Falls, common	6	12	..
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	120	125
American Gas & Electric of New York, preferred	6	39½	39
American Light & Traction of New York, common	..	210	208
American Light & Traction of New York, preferred	6	93	93
American Power & Light of New York, common	4	57	60
American Power & Light of New York, preferred	6	70	72
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	24	23
American Telephone & Telegraph of New York	..	100	99¾
American Water Works & Elec. of New York, common	..	5	3
American Water Works & Elec. of New York, particip	7	9	8
American Water Works & Elec. of New York, first preferred	..	50	45
Appalachian Power, common	..	4	3
Appalachian Power, preferred	7	21	21
Cities Service of New York, common	+extra	437	410
Cities Service of New York, preferred	6	75	75½
Commonwealth Edison of Chicago	8	110¼	109½
Comm. Power, Railway & Light of Jackson, common	..	21	20
Comm. Power, Railway & Light of Jackson, preferred	6	46	45
Federal Light & Traction of New York, common	..	8	7
Federal Light & Traction of New York, preferred	..	43	43
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	49½	48
Northern States Power of Chicago, common	..	65	63
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	62	60½
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	83	80
Public Service of Northern Illinois, Chicago, preferred	6	86	85
Republic Railway & Light of Youngstown, common	4	14	16
Republic Railway & Light of Youngstown, preferred	6	50	50
Standard Gas & Electric of Chicago, common	..	28	27½
Standard Gas & Electric of Chicago, preferred	6	42	41
Tennessee Railway, Light & Power of Chattanooga, common	..	3	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
United Light & Railways of Grand Rapids, common	4	43	41
United Light & Railways of Grand Rapids, preferred	6	70	65
Western Power of San Francisco, common	..	20	21
Western Union Telegraph of New York	extra	88	85¼
Industries.			
Electric Storage of Philadelphia, common	4	141	135
General Electric of Schenectady	8	169½	173½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	53¾	51¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..